CANADIAN
TRANSPORT
COMMISSION

TORONTO COMMUTER RAIL STUDY

FINAL REPORT
1972

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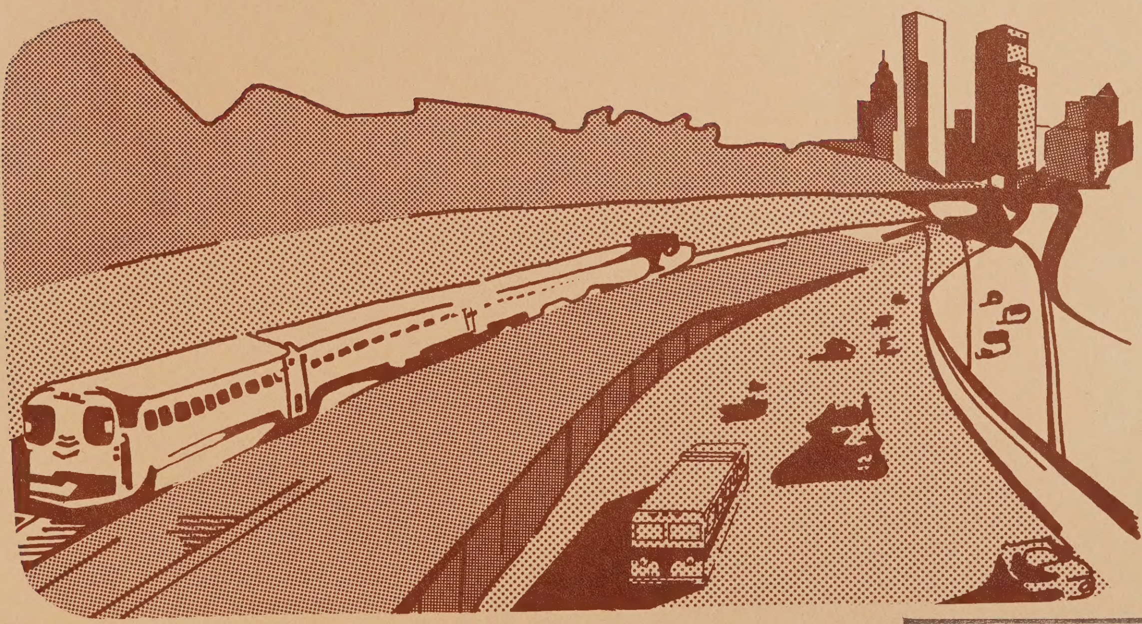

TORONTO COMMUTER RAIL STUDY

Canadian Transport Commission

Report 37

November, 1972

PREFACE

This study has been conducted on behalf of the Minister of Transport and administered through the Canadian Transport Commission. It resulted from a request by the Chairman of the Municipality of Metropolitan Toronto to undertake an assessment of the potential of providing new commuter rail services over existing railroad rights-of-way within Metropolitan Toronto.

Since neither the Metropolitan Corporation nor the Federal Government are directly involved in providing commuter rail services at the present time, no attempt was made to recommend priorities or policy. The major purpose was to provide information that would be acceptable as the basis for negotiations by the various government agencies and organizations, including the railways, that might be involved in the provision of new services.

The active participation of these agencies was requested and obtained throughout the conduct of the study. Presumably, the information presented within this report will also be useful in assisting the Ministry of Transport to assess possible federal involvement in urban transportation.

The project was under the direction of Richard M. Soberman. Douglas P. Floyd was Assistant Director and had major responsibility for coordinating the activities of the various cooperating organizations and agencies as well as most of the technical analysis.

The study would not have been possible without the support of senior officials of both railways, various municipal and provincial government agencies and the Toronto Transit Commission. In this regard, the assistance of Dr. R. A. Bandeen and subsequently Mr. W. D. Piggott, Vice-President, Great Lakes Region, CN, Mr. L. R. Smith, Vice-President, Eastern Region, CP and Messrs. W. Bidell and W. Wronski, Co-Chairmen of the Joint Technical Transportation Planning Committee, is gratefully acknowledged.

Though many individuals contributed information and in some cases drafted parts of the final report, major responsibilities were ably performed by Tom Parkinson of the Canadian Transport Commission, Jack Sutton of CN, Louis Riopel and Doug Walkington of CP, Ven Chi Ma of the Ontario Ministry of Transportation and Communications, Stan Lawrence of the Toronto Transit Commission and Jack Vance of Transportation Systems Associates. Others who must share some of the credit, though none of the errors or omissions include Jim Speirs (CN), Glen Swanson and Charles Pike (CP), William Howard and Hugh Clelland (GO Transit), Rie Kidman and Gerry Johnston (M.T.C.), Jack Sansom (TTC), Bob Schmidt (Ministry of Treasury, Economics and Intergovernmental Affairs), Doug Thwaites and the late John Vardon of the Metropolitan Toronto Planning Board staff, and John Kruger of the Metropolitan Chairman's office.

Facilities and technical assistance were made available through the Toronto Area Airports Project of the Ministry of Transport under the direction of Mr. G.E. McDowell.

SUMMARY

This study was conducted on behalf of the Minister of Transport at the request of the Chairman of the Municipality of Metropolitan Toronto. At the present time, the Federal Government is not directly involved in providing commuter rail services except through subsidies paid for inter-city passenger trains which do provide some limited commuter service. As a result, in lieu of recommendations, the major objective has been to provide a credible information base for negotiations among the government agencies and organizations that would be involved in the provision of new commuter rail services in the Metropolitan Toronto area. To assist in developing this information base and to facilitate implementation in the event decisions are taken to introduce new services, provincial and municipal government agencies as well as both railways actively participated in the conduct of the study by undertaking specific tasks and commitments to provide information.

A number of considerations affect the suitability of existing railroad lines for commuter rail services. These include the physical characteristics of the lines, their use by other rail traffic, and the extent to which improved transportation along these routes is consistent with local and regional planning objectives.

A preliminary analysis of these considerations for eight possible railway lines led to more detailed study in the case of four, namely the CP lines to Malvern and Streetsville and the CN lines to Georgetown and Richmond Hill

as shown in Figure 1. All four terminate at Union Station in downtown Toronto where existing GO Transit services and TTC subway facilities are also concentrated. The two CP lines offer the additional possibility of an alternative downtown terminal at the CP North Toronto station.

In assessing the viability of these four lines, two of the most important considerations are the potential market and costs associated with each. The demand analysis indicates that in the short term, volume potentials are highest on the Georgetown route (comparable in magnitude to patronage on existing GO Transit services), and on the Richmond Hill and Malvern routes, making them all suitable candidates for limited services during peak periods. With the planned growth to the east of Toronto, volume potential on the Malvern route eventually surpasses that of Richmond Hill. Over the long term, therefore, both the Malvern and Georgetown routes appear attractive for full schedule services. The Streetsville route, while lowest in volume potential during the early years, does offer significant relief from the already congested GO Transit Lakeshore West route. The relevant demand information for comparing these various lines is provided in Figures 12 to 15 of Chapter 4.

Cost estimates for providing a range of service frequency on each line are developed in Chapter 5. What the cost analysis shows is that some peak period service is possible by rescheduling normal freight traffic and fleeting commuter trains so as to minimize the need for plant improvements and associated capital costs. However, increasing schedule frequency in a manner which extends the peak period and provides off-peak service results in the need for major plant improvements and correspondingly high capital investment.

Combining the cost and demand information, the analysis indicates that depending upon the specific line and service frequency, new commuter rail services can be provided at operating deficits ranging from 26 to 84¢ per trip and total deficits of $1.00 to $2.29 per trip when all capital costs are included and amortized.

Of the four services considered in detail, a decision has already been made by the Provincial Government to provide limited peak period service on the Georgetown route. For the remaining services, requirements for capital investments to initiate new services would be lowest on the Richmond Hill line. A two train peak period service capable of accommodating almost 3,800 seated passengers daily along the 21 mile route could be provided for a total capital investment of approximately $7.1 million. Providing a third train and an additional 1,900 daily seats would increase total capital investment to $11.4 million. Other individual services range in their requirements for capital investment to as much as $64 million for a full schedule service along the 36 mile route between Streetsville and Malvern providing 15,000 daily seats during peak periods. Implementation time would range from 18 months in the case of the Richmond Hill limited service to a maximum of 3 years for some of the full service alternatives.

The major findings of the study together with conclusions are summarized in Chapter 6. A few of the more important conclusions include the following:

1. It is technically feasible to provide a range of commuter rail services on each of the four lines analyzed. For limited peak period services, operating deficits are reasonable in

relation to other rail services presently offered within the metropolitan area.

2. Limited peak period services are more cost effective than full services due to the poor utilization of commuter rail services in off-peak periods. A quantum jump in capital costs is experienced through the introduction of extended peak period and off-peak services. Data supporting this conclusion are shown in Tables 6.1 and 6.2 and in Figures 19 and 20 of Chapter 6.

3. Decisions on new investment in commuter rail services should not be made in isolation of other possibilities for improving the transportation system. Plans for new commuter rail services should be made within the context of a comprehensive review of the region's total transportation requirements.

4. The Richmond Hill line offers considerable potential for peak period service at minimum total capital investment. This is largely due to the relatively low volume of freight traffic, the high quality of the existing plant facility, and the absence of alternative public transportation in the corridor served by this line.

5. Limited peak period service on the Malvern line also appears to be desirable from the point of view of traffic potential. With the planned

growth to the east, full schedule service may be justified in the future. In addition, because of the potential which this line offers for serving traffic demand generated by the new airport and associated development, it may be of special interest to the Federal Government.

6. The potential of the Georgetown route for full schedule service is the greatest of the four lines under consideration, as evidenced by the decision to introduce limited peak period service in the near future. Experience obtained in operating the limited service will be useful in assessing the full schedule potential of this line.

7. Substantial economies may be achieved through the integration of services on the various lines under consideration. Such economies would result from improved utilization of rolling stock, particularly on the Malvern-Georgetown combination, and centralization of equipment maintenance facilities.

8. The new Metro Centre development in the Union Station area presents certain capacity problems for all commuter rail services using this terminal. However, once improvements are made to accommodate limited increases in commuter traffic, the terminal should be capable of handling a large variety of services without additional capacity requirements.

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Chapter 1

INTRODUCTION

This study was initiated at the request of the Chairman of the Municipality of Metropolitan Toronto and has been undertaken for the Federal Minister of Transport with the cooperation of the Ministry of Transportation and Communications of Ontario, the Toronto Transit Commission, the Metropolitan Toronto Planning Board, Canadian National and Canadian Pacific railways.

The major objective is to assess the potential for providing commuter rail services over existing railroad rights-of-way located within Metropolitan Toronto and its immediate environs.

There have been previous studies of the potential use of railway facilities, first, as part of the Metropolitan Toronto and Region Transportation Study and subsequently as part of the on-going evaluation of GO Transit. Such studies have resulted in the introduction of commuter rail service along the Lakeshore and recent decisions to inaugurate a new GO Transit service to the northwest. The present study differs from previous evaluations in as much as more emphasis is placed on the potential which commuter rail service affords for improving transportation within Metropolitan Toronto. Some of the figures used, particularly those relating to costs, will of course be more up-to-date than similar figures produced several years ago.

While the emphasis in this study is largely technical in nature, the major hurdles to be overcome in implementing new services concern institutional and jurisdictional issues. Clearly, it is technically possible to provide commuter services over existing facilities. Implementation, however, requires negotiations whereby commuter rail services can be provided without unduly prejudicing the commercial operations of the railways, whereby unnecessary crew requirements can be relaxed to improve the cost competitiveness of commuter rail services, and whereby appropriate cost sharing formulae can be developed for the various agencies involved. These negotiations may involve three levels of government as well as both railways. *This study attempts to provide an information base acceptable to the various parties as the basis for such negotiations.*

In keeping with the principle of providing a credible information base for negotiations, the study was designed so as to maximize inputs from the various organizations and agencies that might be involved in providing new commuter rail services. Assistance provided in this way from the various municipal and provincial government departments was coordinated through the Joint Technical Transportation Planning Committee, a committee of senior officials representing the Provincial Ministry of Transportation and Communications, the Toronto Transit Commission, the Metropolitan Toronto Planning Board, and the Metropolitan Toronto Roads and Traffic Department. Assistance and information was obtained from Canadian National and Canadian Pacific railways through separate contractual arrangements between each railway and the Canadian Transport Commission.

In effect, the study team acted as a coordinating body with overall responsibility for final analysis and integration of information produced by the staff of the various cooperating agencies. The flow chart of Figure 2 indicates the major tasks involved, brief descriptions of which are given below:

Identification of Potential Routes

This task involved specifying the basic network of facilities to be evaluated. Previous studies already mentioned, provided a convenient starting point for defining the basic network. This network was modified through an assessment of urban and regional planning goals provided by the Metropolitan Toronto Planning Board and by the Regional Development Branch of the Provincial Ministry of Treasury, Economics and Intergovernmental Affairs. Comments by Canadian National and Canadian Pacific as well as the Toronto Transit Commission concerning the general suitability of different lines and their compatibility with existing or planned rapid transit facilities were also considered.

Patronage and Revenue Forecasts

Considerable demand data has already been collected in the course of various transportation studies within Metropolitan Toronto and the surrounding region. These data, and the forecasting models subsequently developed, form the basis of patronage estimates for each of the rail lines in the network.

Cost Analysis

This task involved generating a series of cost estimating relationships indicating the capital, maintenance and operating costs which would be incurred in providing different service frequencies and capacities. Several types of rolling stock were also considered including equipment now employed by GO Transit and double deck cars similar

to those operated by Canadian Pacific on their Montreal services. Considerable engineering and operational analysis was required, the cost of which was shared by the Federal Government and both railways.

Evaluation

The evaluation of potential lines was approached from two points of view. First, the various lines were compared in terms of their cost effectiveness in providing a basic peak period service, without consideration of patronage estimates. In other words, it was assumed that train lengths could be modified to assure full capacity operation during peak periods.

Second, the lines were compared with respect to their performance under full schedule operation comparable to the schedules now provided by GO Transit along the Lakeshore. Here, the economic analysis involved combining forecasts of potential patronage and revenue with estimates of capital, operating and maintenance costs for each segment of the network.

Conclusions

The conclusions of the study were designed to take the form of commentary on each potential line with respect to the financial aspects, the contribution toward alleviating the metropolitan transportation problem, and the implications for regional and local planning objectives.

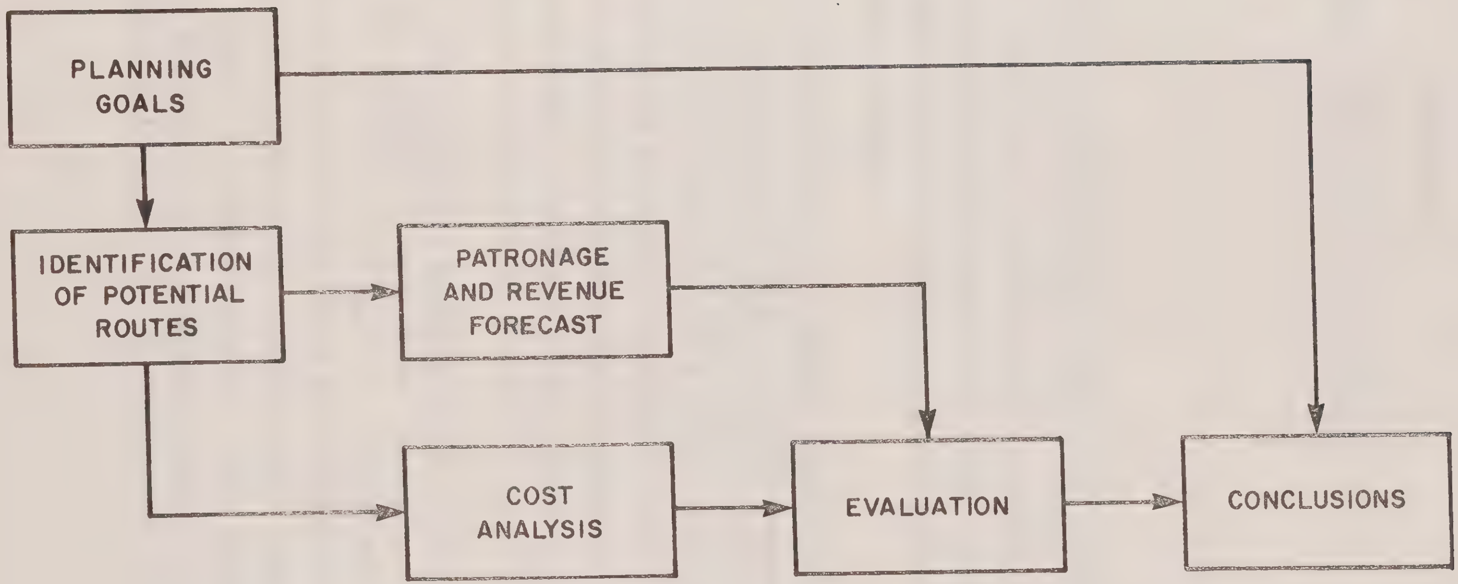
No attempt was made to recommend priorities for developing commuter rail services. Instead, the financial, operational and planning considerations were assembled for the lines under consideration to provide a factual basis for decision making.

The remainder of this report deals with these tasks in more detail and provides the relevant information on costs, patronage and implications for planning objectives. Before turning to these specific tasks however, Chapter 2 attempts to establish some perspectives within which possible new commuter rail services can be viewed by describing the overall system of transportation facilities in Metropolitan Toronto and by discussing some relevant experience with commuter rail operations elsewhere in North America. In Chapter 3, the objectives and programs of various governmental agencies are briefly discussed as the basis for identifying the network of facilities for detailed analysis. Estimates of patronage for the routes selected are developed and presented in Chapter 4 for a planning period beginning in 1972 and ending in 1982. In Chapter 5, the cost information provided by both railways is presented in summary form for two extremes in the range of possible commuter rail services. Cost estimates associated with alternative levels of peak period service are then derived from these basic data and also presented.

The final chapter combines the various patronage and cost data and assesses each of the potential routes in terms of cost effectiveness, subsidy requirements and contribution to regional and local planning objectives. Chapter 6 has been written as far as possible to stand on its own. An understanding of the findings of the study can be obtained from this last Chapter without necessarily reading all of the preceding material.

TORONTO COMMUTER RAIL STUDY FIG. 2

STUDY DESIGN



Chapter 2

COMMUTER RAIL SERVICE IN CONTEXT

Introduction

To many of those concerned with urban transportation, the existence of railways rights-of-way through the core of the central city seems reason enough for providing public passenger transportation along these routes. This simplistic view should be treated with some caution for several reasons.

First, the existence of railway facilities does not necessarily imply their availability for high-frequency passenger operations without extremely high cost or without considerable disruption to the normal freight operations of the railway. High-speed passenger operations require different kinds of facilities and signal systems than low-speed freight operations. In urban areas, integration of the two can often only be achieved at very high cost.

Second, the line-haul portion of a journey represents only one element of the total transportation problem. Access to the railway line and interchange with a downtown distribution system must also be considered to make the total door-to-door journey by commuter rail competitive with alternative forms of transportation. This becomes increasingly more difficult to accomplish when the distribution of trip destinations within an urban area is widely dispersed.

Finally, in assessing the value of commuter rail facilities it is essential to keep in mind that such services constitute only one element of the total transportation system serving a large metropolitan area. Commuter rail services should not be considered in isolation. Comprehensive planning requires that the effectiveness of such services should be related to the effectiveness of alternative investments in transportation infrastructure.

Clearly, the existence of railway facilities in a large growing metropolis represents a capability for carrying people which should ultimately be developed. Perhaps the only real question is when to develop such services relative to other priorities for public transportation improvements. If development of rail capabilities is postponed for a sufficiently long period, then the question must be raised as to whether other technologies might be superimposed on these rights-of-way.

The remainder of this chapter attempts to expand on the context within which new commuter rail services should be viewed. Some of the relevant background information concerning growth in Metropolitan Toronto is summarized together with information on commuter rail experience in Toronto and elsewhere in North America.

Growth of the Region

The Municipality of Metropolitan Toronto was established in 1954, containing then a population of approximately 1.27 million persons in an area of 242 square miles.

By 1971, this population had grown to 2.1 million persons having experienced an overall average growth rate of 50,000 persons annually. The 1980 population forecast for Metropolitan Toronto is estimated to be 2.5 million persons.

Aside from certain tracts of land located mainly in the Borough of Scarborough, very little land is available for new development within Metropolitan Toronto. As a result, housing is currently at a premium and many persons are forced to buy residential property in the adjacent towns and townships. Multiple dwelling units, no longer confined to downtown areas near public transit facilities, are now being located in the outer fringes of the metropolitan area. In addition to a general increase in population density, this trend results in a shift in density distribution. Residential density is decreasing in the immediate vicinity of the central business district, due to the gradual redevelopment of land for commercial and institutional uses, and increasing in the fringe areas and those areas beyond the limits of Metropolitan Toronto.

Both the City of Toronto and Metropolitan Toronto have maintained a policy of promoting a strong central business district with respect to business and commercial activity. In 1971, for example, there were about 34 million sq.ft. of office space within the area bounded by Bloor, Jarvis, Front and Simcoe Streets. By 1973, an additional 4 million sq.ft. of office space is estimated to be on the market within this same area. As a result, a definite increase in the number of downtown workers is expected. Although some residential capacity is planned in connection with major downtown redevelopments such as Metro Centre and Harbour Square, the majority of these workers will find

residential locations in the outer areas of Metropolitan Toronto, resulting in a greater demand upon the centrally oriented transportation facilities.

The Existing Transportation System

The locations of major transportation facilities that now exist within Metropolitan Toronto are shown in Figure 1. The completed portion of the subway system now totals 21 miles, with a 5.3 mile extension of the Yonge Street route currently scheduled for opening within the next two years. A further 6 mile extension of the University Avenue line using the right-of-way of the partially completed Spadina expressway has also recently been approved. The Metropolitan Corporation has also constructed the Gardiner Expressway and the Don Valley Parkway and recommended other expressways to supplement the service provided by major provincial freeways within Metro such as Highway 401 and Highway 427.

In 1962 the provincial government recognized the need for a comprehensive assessment of transportation requirements in the Toronto region, and initiated the Metropolitan Toronto and Region Transportation Study (MTARTS). Recommendations of that study ultimately led to the establishment of the Province of Ontario's GO Transit service in May 1967. This service extends from Oakville to Pickering through Union Station in Toronto, using the Canadian National Oakville and Belleville Subdivisions. By the end of 1967, when the system was in full service, weekday ridership averaged about 16,000 persons. Currently, the average weekday ridership is

approximately 20,000 and capacity problems are now being experienced during peak periods. To keep these figures in proper perspective, it should be noted that in 1972, of 94,000 work trips entering the central business district during the morning peak, 70,000 were carried by public transit. GO Transit carried 6,700 of these, or approximately 7.2% of total peak period work trips.

During the past few years, expansion of Metro's transportation system has been delayed for a number of reasons including major strikes that have delayed subway construction. Since the completion of the Don Valley Parkway to Highway 401 in 1967, no other major downtown oriented road facilities have been completed. Moreover, public concern over continued growth in automobile traffic has raised considerable doubt as to the future of new expressway proposals. As a result of this concern, the Provincial Cabinet in June 1971, decided to cancel the now famous Spadina Expressway (officially the William R. Allen Expressway), and promised more emphasis on public transportation.

Generally, the gap between travel demand and supply in the Toronto region is widening with the result that peak period congestion on both transit and road facilities is becoming progressively worse. Partial alleviation of this problem may be found in the expansion of commuter rail facilities. Existing rail lines in the Toronto area radiate from the downtown area like the spokes of a half-wheel. Two lines in particular, penetrate the Northeast and Northwest of Metropolitan Toronto where transit coverage now relies on bus services feeding the extremities of the subway system.

All the lines continue into the adjacent townships, thereby providing potential service to most of the towns which are undergoing rapid residential growth. Some indication of the provincial government's intention of taking advantage of this potential was given when plans were announced in October 1971 to introduce a new GO Transit service on the CN line between Georgetown and Union Station.

The concept of utilizing existing railway rights-of-way to service centrally oriented trips is, of course, not a new one. The 1966 Metropolitan Toronto Transportation Plan, for example, recognized the need to integrate rail commuter systems with other elements of the public transportation system.

The North American Experience with Commuter Rail Operations

There are approximately 85 commuter rail services in North America, as summarized in Table 2.1. These services handle from 50,000 to 80,000,000 trips per year and use a variety of rolling stock ranging from vintage coaches hauled by diesel locomotives to electric multiple-unit bi-level cars. Most of them share three common characteristics.

First, railway facilities are used at relatively low cost, either because they have been fully amortized or because they are valued at much less than the present day cost of acquiring the land, buildings and track structures. In other words, relative to the costs of acquiring land and constructing entirely new facilities, the capital cost of providing passenger capacity on existing railways may be low.

Table 2·1 SUMMARY OF NORTH AMERICAN COMMUTER RAIL SERVICES

City	Railway	Line	Length (miles)	Weekday Trains (both ways)	Annual Passengers (1000)[1]	Type of Operation[3]	Type of Subsidy (if any)[4]
Chicago	Burlington Northern	Aurora	38	62	9,726	DBPT	-
Chicago	Chicago North Western	North	52	66			
Chicago	Chicago North Western	North West	90	677	25,046	DBP	-
Chicago	Chicago North Western	West	35	59			
Chicago	Gulf Mobile and Ohio	Joliet	37	2	50	D	-
Chicago	Illinois Central	Main	29				
Chicago	Illinois Central	Blue Island	4	268	18,785	MB	C
Chicago	Illinois Central	South Chicago	4				
Chicago	Milwaukee Road	North	75	36	5,955	DPT	C
Chicago	Milwaukee Road	West	37	37			
Chicago	Norfolk and Western	-	23	2	100	D	-
Chicago	Penn Central	Valparaiso	44	4	195	D	-
Chicago	Rock Island	-	46	63	6,600	DPT	S
Chicago	South Shore	Michigan City	88	50	2,682	M	S
Boston	Boston and Maine	Lowell		75			
Boston	Boston and Maine	Eastern		55			
Boston	Boston and Maine	Conard	176	41	5,556	R	O
Boston	Boston and Maine	Reading		60			
Boston	Boston and Maine	Bedford		2			
Boston	Boston and Maine	Haverhill		2			
Boston	Boston and Maine	Newburyport		2			
Boston	Penn Central	New Haven	79	57	2,600	DR	O
Boston	Penn Central	Albany	44	6	585	D	-
New York	Penn Central/MTA	Harlem	149	179	28,000	MD	CO
New York	Penn Central/MTA	Hudson		162			
New York	Penn Central/MTA	New Haven	136	216	-	MDR	CO
New York	MTA	Long Island	322	n/a	79,560	MD	CO
New York	CRRNJ	Raritan	61	92	5,020	DP	CO
New York	CRRNJ	Bay Head Jct.	57	14	2,620	D	CO
New York	Penn Central	NYLBRR	67	20	4,165	ED	C
New York	Penn Central	Trenton	58	94	9,516	ME	C
New York	Penn Central	South Amboy	9	20	2,184	ME	C
New York	Penn Central	Princeton	3	56	-	M	C
New York	Erie Lackawanna	Bergen	87				
New York	Erie Lackawanna	Pascack	31				
New York	Erie Lackawanna	Boonton	48	248	21,568	MDPT	CO
New York	Erie Lackawanna	Morristown					
New York	Erie Lackawanna	Gladstone	83				
New York	Erie Lackawanna	Montclair					
Phila.	Penn Central	Chestnut Hill	12	75			
Phila.	Penn Central	Media	14	76			
Phila.	Penn Central	Westchester	14	7			
Phila.	Penn Central	Levittown	27	42			
Phila.	Penn Central	Pauli	20	111	19,524	ME	CO
Phila.	Penn Central	Managunk	8	36			
Phila.	Penn Central	Marcus Hoolk	17	51			
Phila.	Penn Central	Wilmington	10	20			
Phila.	Penn Central	Parkesburgh	84	18			
Phila.	Reading	Bethlehem	56	14			
Phila.	Reading	Norristown	18	68			
Phila.	Reading	Chestnut Hill	11	74			
Phila.	Reading	Doyestown	34	28			
Phila.	Reading	Fox Chas	26	52			
Phila.	Reading	Pottsville	94	14	13,419	MRDP	CO
Phila.	Reading	Lansdale	24	70			
Phila.	Reading	Glenside	12	168[2]			
Phila.	Reading	West Trenton	33	50			
Phila.	Reading	Hatboro	19	52			
Phila.	Reading	Newark	-	4			
Phila.	PRSL	Seashore	123	10	104	R	CO
Washington	Baltimore and Ohio	Baltimore	37	8	162	R	-
Washington	Baltimore and Ohio	Brunswick	73	8	297	R	-
Washington	Penn Central	Baltimore	40	4	195	M	-
Pittsburgh	Baltimore and Ohio	McKeesport	18	14	198	R	-
Pittsburgh	P and LE	Beaver Falls	31	2	78	D	-
Detroit	Grand Trunk Western	-	26	4	364	D	-
Detroit	Penn Central	-	36	2	-	DR	-
Cleveland	Erie Lackawanna	-	66	2	60	D	-
San Fran.	Southern Pacific	-	47	44	5,825	DB	-
Montreal	Canadian National	Tunnel	17	78	7,282	M	O
Montreal	Canadian National	St. Hilaire	21	2	567	D	O
Montreal	Canadian Pacific	Lakeshore	40	24	3,891	DBPTR	S
Montreal	Canadian Pacific	Farnham	43	2	123	D	S
Montreal	Canadian Pacific	Ste. Therese	26	2	81	D	S
Toronto	CN/GO Transit	Lakeshore	42	95	5,102	DPR	CO

Note: 1. All figures are for 1970 with minor exceptions where 1969 data has been used. This table is provided for broad comparion purposes and some tolerance should be allowed in patronage figures as methods and accuracy of counts varies.

2. Note that a few listed services include consolidation of trains from other routes.

3. Key to operation: D - Diesel locomotive hauled coaches; B - Bilevel Equipment; E - Electric locomotive hauled coaches; M - Electric multiple units; P - Push pull operation; PT - Part Push Pull operation; R - Rail Diesel Cars. Note that railroads substitute other equipment at times.

4. Key to subsidies: C - Capital Subsidies; S - Aid being sought; O - Operating Subsidies.

5. CRRNJ - Central Railroad of New Jersey, NYLBRR - New York and Long Branch Railroad, PRSL - Pennsylvania Reading Seashore Lines, P and LE - Pittsburgh and Lake Erie.

However, the cost generally allocated to commuter services, even for the use of existing and somewhat aged facilities, may still be very high when related to the number of passengers actually carried.

Second, labour productivity is low due to union requirements for manning trains with much larger crews than are required to operate trains under present day technology. These crew requirements often introduce an operating bias to run longer trains at infrequent intervals whereas the demand may actually be for more frequent service using shorter trains.

Third, depending upon the accounting procedures used, almost all of the services summarized in Table 2.1 involve deficit operations. Some of these deficits or subsidies for certain selected services are shown in Table 2.2. In Canada, only Montreal has traditionally enjoyed commuter rail services provided by the railways. Although both services come close to meeting their direct costs, under the Canadian Transport Commission's costing rules the services do show substantial deficits.

Historically, commuter traffic was at one time profitable and many facilities such as stations and multiple track route segments in urban areas were built specifically to accommodate commuter traffic. In most cases, however, commuter operations were instituted by the railways as an afterthought, and one which was secondary to their inter-city passenger and freight hauling objectives. As a result, much of the infrastructure still in use today is unsuitable for performing fast, low cost commuter service. For example,

Table 2.2

Examples of Commuter Rail Operating Statistics in North America (1970)[1]

Service	Annual Passengers (1000's)[2]	Week-day trains	Average Cost per Pass. Mile (¢)	Average Revenue per Pass. Mile (¢)	Average Revenue per Pass. Trip ($)	Average Loss or Subsidy per Pass. Trip ($)
Toronto[3]						
CP Havelock	70	2R	7.4	4.3	1.60	1.14
CN Markham	14	2	25.8	4.2	0.72	3.70[5]
CN Guelph	185	2	6.1	3.7	0.61	0.92
GO Transit	5,100	95[6]	9.9	4.5	0.66	0.78
Montreal						
CN Tunnel	7,280	78	7.1	4.0	0.38	0.29
CP Lakeshore	3,580	24	8.9	4.6	0.61	0.57
United States[7]						
Burlington Northern	9,720	62	4.0	3.6	0.64	0.007
Chicago North Western	25,000	192	3.9	3.9	0.81	none[8]
Milwaukee	5,960	73	n/a	n/a	0.83	0.17
Rock Island	6,600	63	5.6	4.4	0.73	0.19
Boston & Maine	5,560	237R	9.0	5.8	0.95	0.54
Reading	13,400	385	n/a	n/a	0.61	0.44
B&O (Wash. D.C.)	459	14R	4.9	3.0	0.85	0.55
Southern Pacific	5,830	44	4.2	2.8	0.69	0.34

Notes:
1. Care should be taken in using these comparisons as cost allocation procedures differ from one railroad to the next.
2. Does not include employee or reduced fare travel in all cases.
3. The CP Havelock, CN Markham, and CN Guelph services are classified by the Canadian Transport Commission (C.T.C.) as intercity services, but they fulfill a commuter service role due to the nature of their operation. Data for these services should be treated judiciously; subsidies are paid by the C.T.C.
4. R denotes self-propelled RDC cars on all or most trains.
5. 1969 data
6. Trains which pass through Union Station are counted twice.
7. For location of services in U.S. see Table 2.1.
8. Very low maintenance-of-way costs assigned to this service result in a negligible loss.

signal systems designed for freight and inter-city passenger traffic are often unsuitable for high frequency commuter service. Low level platforms, designed to accommodate freights and long distance trains, result in labour intensive loading and unloading. Moreover, traditional techniques for ticketing and fare collection are often inefficient for the high volume and relatively short distance characteristics of commuter rail operations.

Labour agreements based on inter-city experience present particular problems with respect to commuter rail operations. As previously mentioned, crew requirements are generally excessive in the light of modern technology. In addition, work rules designed for long distance services are often inadequate to cope with the requirements of "short turn-around" services. The net effect is relatively low labour productivity which, in times of rapidly increasing wages, has led to greater and greater operating deficits.

Other factors have also contributed to the unhealthy financial position of most commuter rail operations. Patronage is increasingly concentrated in the two peak periods resulting in very poor utilization of rolling stock and facilities. As other railway services are discontinued or reduced, a larger proportion of the overhead costs are allocated to fewer and fewer commuter trains, often resulting in a never ending spiral of high costs, poor service and reduced patronage. In New York, for example, the Harlem and Hudson commuter divisions of the Metropolitan Transportation Authority, both operated by the Penn-Central Railroad, have moved from a break even operation three years ago to a deficit operation in excess of $20 million in 1972.

In many cases, services have continued only because regulatory agencies would not permit discontinuance. In other cases, a renewed interest in commuter rail services has been observed where public agencies have been confronted with more expensive and possibly less effective highway proposals or where public values with respect to noise and air pollution provides strong support for transit subsidies.

The Toronto Experience with Commuter Rail Service

Canadian National and Canadian Pacific together operate ten different rail lines or subdivisions that penetrate downtown Toronto. These are shown in Figure 3 and briefly described below:

1. CN Oakville Subdivision (to Oakville). Used by the GO Transit Lakeshore West service, by CN intercity service to Niagara Falls, London and Windsor, and by the Toronto Hamilton and Buffalo Railway (CP) for service to Buffalo with connections to New York City (68 trains daily).

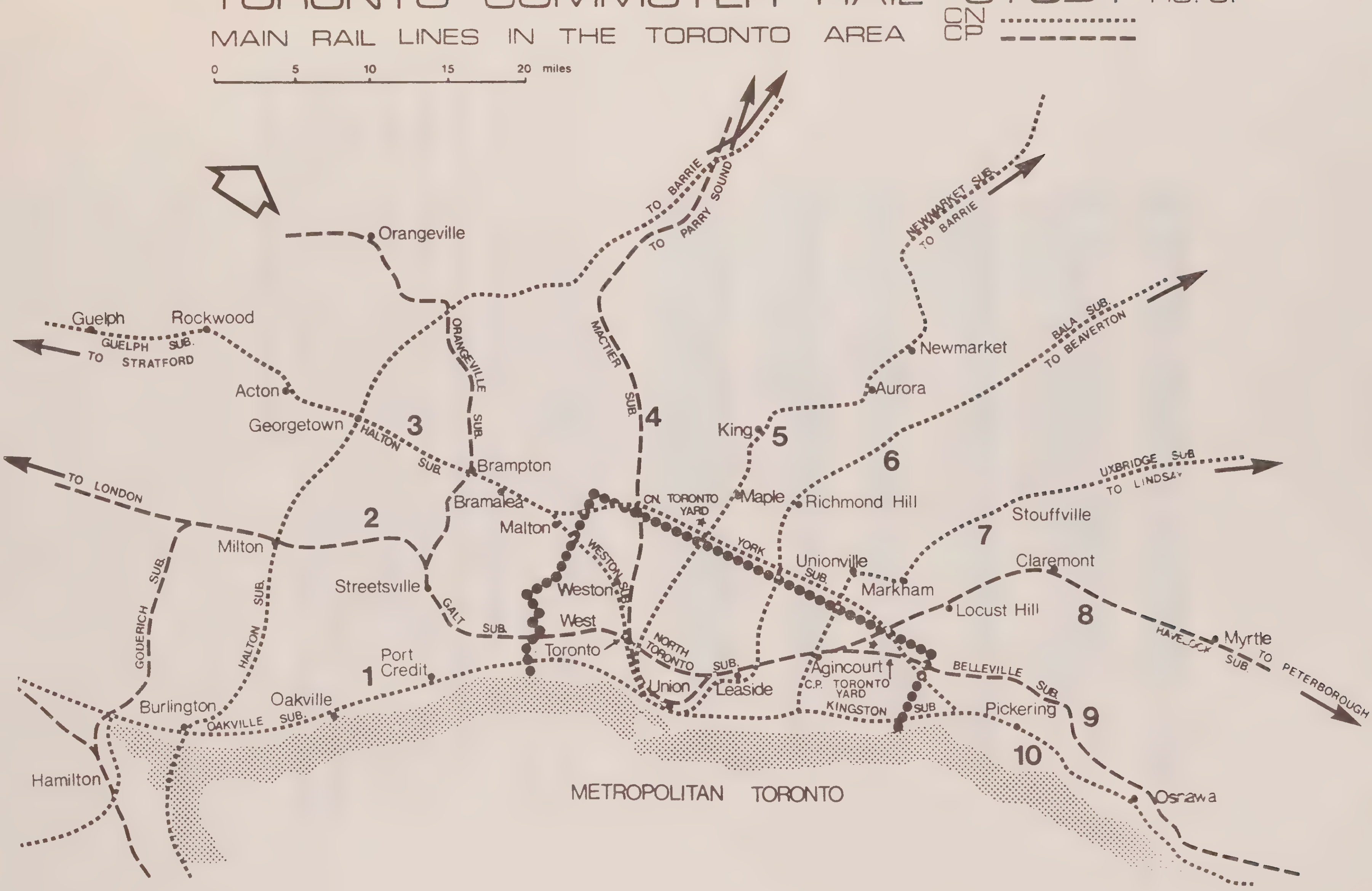
2. CP Galt Subdivision (to Streetsville). No passenger services following Canadian Transport Commission permission to discontinue the London and Windsor service on July 3, 1971.

3. CN Halton Subdivision (to Georgetown). Intercity passenger service to Stratford, London and Sarnia; local service to Guelph (10 trains daily).

4. CP Mactier Subdivision (to Woodbridge). Used by the transcontinental train 'The Canadian' with no local stops (2 trains daily).

TORONTO COMMUTER RAIL STUDY FIG. 3.

MAIN RAIL LINES IN THE TORONTO AREA



5. <u>CN Newmarket Subdivision (to Newmarket)</u>. Used by the Super Continental to Vancouver (2 trains daily).

6. <u>CN Bala Subdivision (to Richmond Hill)</u>. Used by intercity passenger trains to North Bay, Cochrane and Kapuskasing (Ontario Northland Railway). (2 trains daily).

7. <u>CN Uxbridge Subdivision (to Markham)</u>. Local service to Markham and Stouffville (2 trains daily).

8. <u>CP Havelock Subdivision (to Peterborough)</u>. Local service to Peterborough and Havelock (2 trains daily).

9. <u>CP Belleville Subdivision (to Oshawa)</u>. No service beyond connections with Peterborough line at Agincourt.

10. <u>CN Kingston Subdivision (to Pickering)</u>. Used by the GO Transit Lakeshore East Service, and by CN intercity service to Kingston, Ottawa and Montreal (62 trains daily).

As noted, only some of the lines actually accommodate passenger services and of these, only the GO Transit service operated by CN for the Province of Ontario can strictly be defined as a commuter service. The remaining passenger trains are defined by the Canadian Transport Commission as intercity trains, some of which do, in fact, provide limited service for commuters. All such services, however, lose money and under the terms of the National Transportation Act the railways either now receive or have requested subsidies of 80% of actual losses from the Canadian Transport Commission.

A brief description of those passenger trains which do provide some commuter service is provided below together with the description of the GO Transit service. Some comparative statistics and characteristics are summarized in Table 2.3. The data shown are not strictly comparable since passenger estimates are based on extrapolations of short counts and many of the costs are for different time periods. In some cases also, there are differences of opinion between the Canadian Transport Commission and the railway as to the manner of allocating costs to passenger services. However, the statistics shown in Table 2.3 give some indication of the relative performance of the existing services for purposes of comparison with possible new services.

Union Station - Guelph (CN). One round trip is operated each weekday using locomotive hauled trains. Following a petition by CN for abandonment of the service, the railway was ordered by the CTC to replace the older non-air-conditioned cars in 1970 with six air-conditioned cars containing sixty-four seats each.

Total route length is 48.3 miles and takes 100 minutes out-bound and 90 minutes in-bound for average speeds of 29 mph and 33 mph respectively. The portion of the route used primarily by commuters lies between Georgetown and Union Station, (and more specifically, from Brampton to Union), a distance of 29.4 miles requiring running times of 66 minutes out-bound and 58 minutes in-bound for average speeds of 27 mph and 30 mph. Arrival at Union Station is at 0800 and departure at 1725.

Other intercity trains operate over this route but are not scheduled to offer service to commuters. Train 658 from Stratford leaves Georgetown at 0803, arriving at Union Station at 0855 and does provide some commuter service.

Table 2.3

Comparison of Rail Passenger Services in the Toronto Area

Item	Service between Union and Guelph	Service between Union and Markham	Service between Union and Havelock	GO Transit
Year	1970	1969	1970	1970
Route length (mi.)	48.8	22.3	101	42.3
Trains per day	2	1	2	56[1]
Seats per day	768	180	180	24000[1]
Average speed (mph)	31	31	38	32
Annual passengers (1000)	200	14	70[2]	5102
Annual Costs ($1000)	338[3]	74.5	212	7374[4]
Annual Revenue ($1000)	122	10.2	112	3393
Annual Loss ($1000)	216	64.3	100	3980
Annual Subsidy ($1000)	172[5]	51.4[5]	80[5]	3981[6]
Avg. loss ($/passenger trip)	1.08	4.59	1.43	0.78
Avg. subsidy ($/passenger trip)	.86	3.70	1.14	0.78
Annual subsidy per regular commuter ($)	449	920	570	n/a

Notes:

1. Weekday, both directions
2. Based on a two week count in July
3. Change in equipment ordered by C.T.C. estimated to increase costs to $449,000 in 1971.
4. Includes equipment depreciation and interest on capital investment. GO Transit shows operating costs of $4,970,000.
5. Federal
6. Provincial

n/a Not available

With the introduction of the Province of Ontario's new GO Transit service to Georgetown, anticipated to begin in late 1973, CN's application to discontinue trains 986 and 987 will probably be reviewed. The present CTC subsidy is approximately $200,000 per year.

Union Station-Markham (CN). Until the CTC's decision on the railway application to discontinue this service, only one trip per day was operated in one direction from Union Station to Markham. The CTC directive of 31 May, 1971 ordered the service to be operated in both directions and to be extended north to Stouffville, a distance of 28.6 miles from Union Station. A two-car self-propelled unit offers 180 seats in each direction. This equipment is air-conditioned and requires a three-man crew. No service is provided on weekends.

The extended service to Stouffville takes 55 minutes for an average speed of 31 mph. Arrival at Union Station is at 0805 and departure at 1720.

Union Station to Havelock (CP). Prior to the Canadian Pacific application for discontinuance, this service consisted of one self-propelled unit providing one round trip each day. The CTC ordered continuation of the service and the addition of a second car, thereby providing approximately 180 seats over a distance of 101 miles. The total trip takes 2 hours and 40 minutes for an average speed of 38 mph, arriving Union Station at 0850 and departing at 1730. The inner commuter portion of the service averages approximately 33 mph and includes stops at Agincourt and Leaside.

GO Transit. GO Transit is a commuter service operated by Canadian National for the Province of Ontario. Service, fares and marketing policies are determined by the Provincial

> Government through the Ministry of Transportation and Communications GO Transit office. All losses on the service are subsidized by the Provincial Government which also paid for the initial capital costs of track improvement and acquisition of rolling stock.
>
> The service, which was initiated in May 1967, following studies by the Metropolitan Toronto and Region Transportation Study, was made possible partly as a result of Canadian National's decision to relocate a new classification yard north of Toronto at Maple. As a result, freight diverted from the Oakville and Kingston subdivisions released some capacity for passenger operations along the Lakeshore.
>
> On weekdays, 28 trains operate daily in each direction between Oakville and Pickering. Two of the daily trains bound for Oakville continue to Hamilton. On weekends and holidays 17 trains are operated in each direction.
>
> Pickering is 20.9 miles from Union Station and Oakville 21.4 miles with typical schedule speeds averaging 32 mph. Entirely new equipment was specified for the service and purchased by the Provincial Government. Coaches contain 94 seats and are hauled by 3000 hp. locomotives equipped for push-pull operation. Air-conditioned self-propelled cars are also available for off-peak service.
>
> By most standards, the service is considered to be an outstanding success and is extremely popular with the public. Present volume substantially exceeds original patronage estimates and serious consideration is now being given to expanding the capacity of the service.

As evidenced by the figures shown in Table 2.3, those regular passenger trains which do provide some peak period service differ almost by an order of magnitude from the commuter service offered by GO-Transit in terms of service frequency and capacity. Such specially tailored

commuter services differ again almost by another order of magnitude from rapid transit systems which offer a schedule-free service that is characterized by high capacity throughout the day and relatively close station spacing.

Differences between commuter rail and rapid transit services are described by the data of Table 2.4 which compares GO Transit and TTC subway operations. Some of the statistics shown in this table are not strictly comparable. For example, contractual arrangements between GO Transit and Canadian National include payments for amounts representing rental of the capital facilities used. In the case of the TTC however, facilities are owned by the Commission or by Metropolitan Toronto and are not capitalized as part of the annual operating cost.

Despite these qualifications, the data of Table 2.4 do highlight the differences in labour costs between a commuter rail and a rapid transit operation. Train crew costs per vehicle mile on GO Transit are 2.6 times greater than on the TTC, reflecting the railway union requirements of 3 or 5 men per train as opposed to the TTC's 2-man crews.[1] In addition, railway union rules require payment on the basis of mileage, whereas TTC crews are paid on an hourly basis. Labour costs for fare collection per passenger on GO Transit are also significant being 5.4 times greater than on the TTC. In part, this is explained by the different fare structures since the TTC has a flat fare, whereas GO Transit has incremental fares that require ticket checks both entering and leaving the

---

1. As a result of labour negotiations in 1972, crew requirements for locomotive hauled trains have been reduced from 5 to 4 men for GO Transit. The requirement for RDC trains remains at 3 men. Note that the ratios derived here would change notably if 1972 data were used with associated decreased labour costs.

system. The TTC also utilizes automatic turnstiles, the cost of which is excluded from this ratio.

These large ratios demonstrate the real distinction between the TTC subway and GO Transit operations. The subway is a heavy volume service in which operating economies are achieved through heavy capital investment in plant. The GO Transit operation is a low to moderate volume service that depends on using existing facilities which are valued at costs lower than their true present day worth. This economical use of existing facilities offsets the lower efficiencies associated with railway operating practice.

There is nevertheless, some overlap between the upper limits of *capacity* possible on a commuter rail service and the lower range of *patronage* actually experienced on certain rapid transit lines. In some cases, commuter rail service may represent a viable alternative to the construction of conventional rapid transit. There are examples in some U.S. cities of railroads that have been converted to rapid transit operations. Generally, the passenger volumes were heavy enough to support the capital costs involved, and the financial state of the existing railroad resulted in little confrontation with the railroad unions. This situation does not exist in Toronto where most of the rail lines under consideration for future commuter service are moderately well utilized by existing railway freight and passenger services for at least a portion of their route, and estimates of patronage on the various routes are sufficiently low to preclude consideration of rapid transit type operation.

Table 2.4

Comparative Data on TTC Subway and GO Transit Operations (1970)

Item	TTC Subway	GO Transit
Physical Data		
Route Miles	21	42
Number of Stations	44	12
Average Station spacing (miles)	0.49	3.82
Average length of ride (miles)	3.52	14.6
Average speed (mph)	19	32
Number of Passenger Cars	334	63
Annual Revenue Car-Miles (1000's)	22,700	2,830
Annual Revenue Car-Miles/Car	68,100	44,900
Annual Seat-Miles (millions)	1,700	266
Annual Passengers (millions)	98.5	5.1
Financial Data in $1,000		
Total Revenue[1]	17,200	3,390
Operating Expenses	21,900	4,970
Depreciation	3,180	644
Debt Service	3,110	1,760
Debt Service (Metro)[2]	6,530	-
Total Annual Costs	34,780	7,370
Operating Cost/Revenue	1.28	1.46
Total Cost/Revenue	2,02	2.17

/Cont'd

Table 2.4: Cont'd

Item	TTC Subway	GO Transit
Unit Financial Data in Cents		
Revenue per Seat-Mile	1.01	1.27
Operating Expenses per Seat-Mile	1.2	1.8
Crew Costs per Seat-Mile	0.17	0.35
Crew Costs per Car-Mile	12.5	33.0
Fare Collection Costs per Seat-Mile[3]	0.17	0.31
Fare Collection Costs per Passenger[3]	2.94	15.9
Fuel Costs per Car-Mile[4]	9.3	7.4
Maintenance Cost per Car-Mile[5]	18.8	65.8
Insurance per Car-Mile	0.79	3.47
Operating Cost Breakdown in %		
Crew	12.9	18.8
Fare Collection	13.2	16.4
Fuel	9.6	4.2
Vehicle Maintenance	19.5	37.4
Insurance	1.3	1.9
Total Operating Labour	26.1	35.2

Notes:

1. TTC subway revenue is based on estimates that 60% of the passengers transfer from surface transit, in which case 50% of their fare is attributed to subway revenue. The average revenue on TTC is 24.8¢ per passenger, which accounts for cash fares 30¢, ticket fares 25¢, children's fares 8.3¢, and two-zone fares 40¢. The above estimate allocates an average fare of 17.4¢ to subway rides. This is a very artificial breakdown in that the subway is an integral part of the transit

/Cont'd.

Notes: Cont'd

system. Without the subway, some surface feeder routes would not exist while others would carry passengers for their entire journey at a considerably greater expense than on the subway. Thus the subway revenue figure fails to truly reflect the economic benefit of the subway to the entire transit system. Alternate methods of allocating revenue to subway operation would give \$23.5 million on a single fare basis or \$33.9 million on the basis of a division of total revenue by the ratio of seat miles offered on the subway to total system seat miles. In the latter case, the subway operating ratio drops to 64.7% and the total cost/revenue ratio to 102%.

2. Represents servicing the proportion of the Yonge and Bloor subway cost provided by Metropolitan Toronto on an identical basis to the TTC portion.

3. GO figures include auditing; TTC figures do not.

4. Go figures are for fuel oil plus tax; TTC figures are for electric power.

5. On the average, TTC cars are considerably older than GO cars.

Chapter 3

IDENTIFICATION OF POTENTIAL ROUTES

Introduction

The previous chapter identified 10 railway lines that presently penetrate the core of Metropolitan Toronto. These lines vary considerably in terms of physical characteristics, degree of utilization by other traffic, and general suitability with respect to the location of potential markets and possibilities of integration with other elements of the total transportation system. Clearly, some rail lines will be more serious contenders for new commuter service than others and it was therefore important early in the study to establish a basic network of facilities to be emphasized in the analysis.

A number of criteria can be used to determine which lines should be studied first and which lines should be excluded from further consideration. These criteria will vary from agency to agency. The railways, for example, tend to assign higher priority to lines on which interference with existing freight traffic would be minimized. Provincial Government agencies may be more concerned with selecting lines in terms of their impact on regional planning objectives whereas the impact of new services on alleviating transportation problems within Metropolitan Toronto may be of greater interest at the local level. In arriving at the basic network of facilities, the planning goals and associated development proposals of all agencies and governmental organizations with a bona fide interest in commuter rail services were considered.

These goals are summarized in the following section and provide the background against which the final commuter rail network was selected for study.

Planning Goals and Development Proposals

1. The Toronto-Centred Region Concept

In May, 1970, the Government of Ontario published the document *Design for Development: The Toronto-Centred Region* which provides the basic concept for the comprehensive development of the area within an arc extending 90 miles from Toronto. The report was co-ordinated by the Regional Development Branch of the Department of Treasury and Economics (now the Ministry of Treasury, Economics and Intergovernmental Affairs). The main objectives of this concept, as quoted in the report are to:

(i) shape the growth of the Region's metropolitan core into a two-tiered urbanized area,

(ii) encourage growth in selected communities beyond easy commuting range of Metropolitan Toronto, and thus help to decentralize the Region and prevent a swollen growth within and near Metropolitan Toronto,

(iii) set basic guidelines for regional land use.

These development principles and objectives were supported by the earlier Metropolitan Toronto and Region Transportation Study (MTARTS) proposals and the public response to them. Subsequently, many briefs and submissions were presented by the public and a further document, *A Status Report on the Toronto-Centred Region* was released in August, 1971. The purpose of the Status Report was to refine the basic development concept based on public response and institutional

changes, in order to provide a sound basis for public and private decisions within the framework of a co-ordinated set of government objectives.

At its extremities, the Toronto-Centred Region (TCR) encompasses population centres such as, Cobourg, Peterborough, Orillia, Midland, Collingwood, Kitchener-Waterloo, Brantford, and Hamilton. Within this geographic setting, the Region is stratified into three zones as outlined in the TCR report:

Zone 1. The *lakeshore urbanized area* is that zone which encompasses the Metropolitan core itself, plus reasonably adjacent urban settlement.

Zone 2. The *commutershed* is that zone beyond the lakeshore urbanized area but within easy daily commuting range of employment in Toronto.

Zone 3. The *peripheral zone* is that belt beyond the commutershed which is still well within the orbit of highly specialized influences of the Metropolitan core. Its economy is tied to the Region's core, and it acts as open space and recreation territory for the urban population.

The development concept for the *lakeshore urbanized area* from Bowmanville to Hamilton is a modification of Goals Plan II of MTARTS. Zone 1 is expected to accommodate 5.7 million of the Region's 8 million people by the year 2000. Of this number, approximately 3.1 million are expected to be in Metropolitan Toronto and its immediate northern fringe, 1.85 million to the west and 750,000 to the east of Metropolitan Toronto. The urban centres in Zone 1 would be arranged in a linear urbanized area from Bowmanville to Hamilton, whereby the structure would be basically a two-tiered arrangement of cities separated by a Parkway Belt system of mainly non-urban

uses. This Parkway Belt would be multi-purpose service system incorporating transportation, pipeline, electrical power, water, and sewer facilities with open space added. Further details concerning the refinement of the concept for Zone 1 are available in the *Status Report* mentioned above.

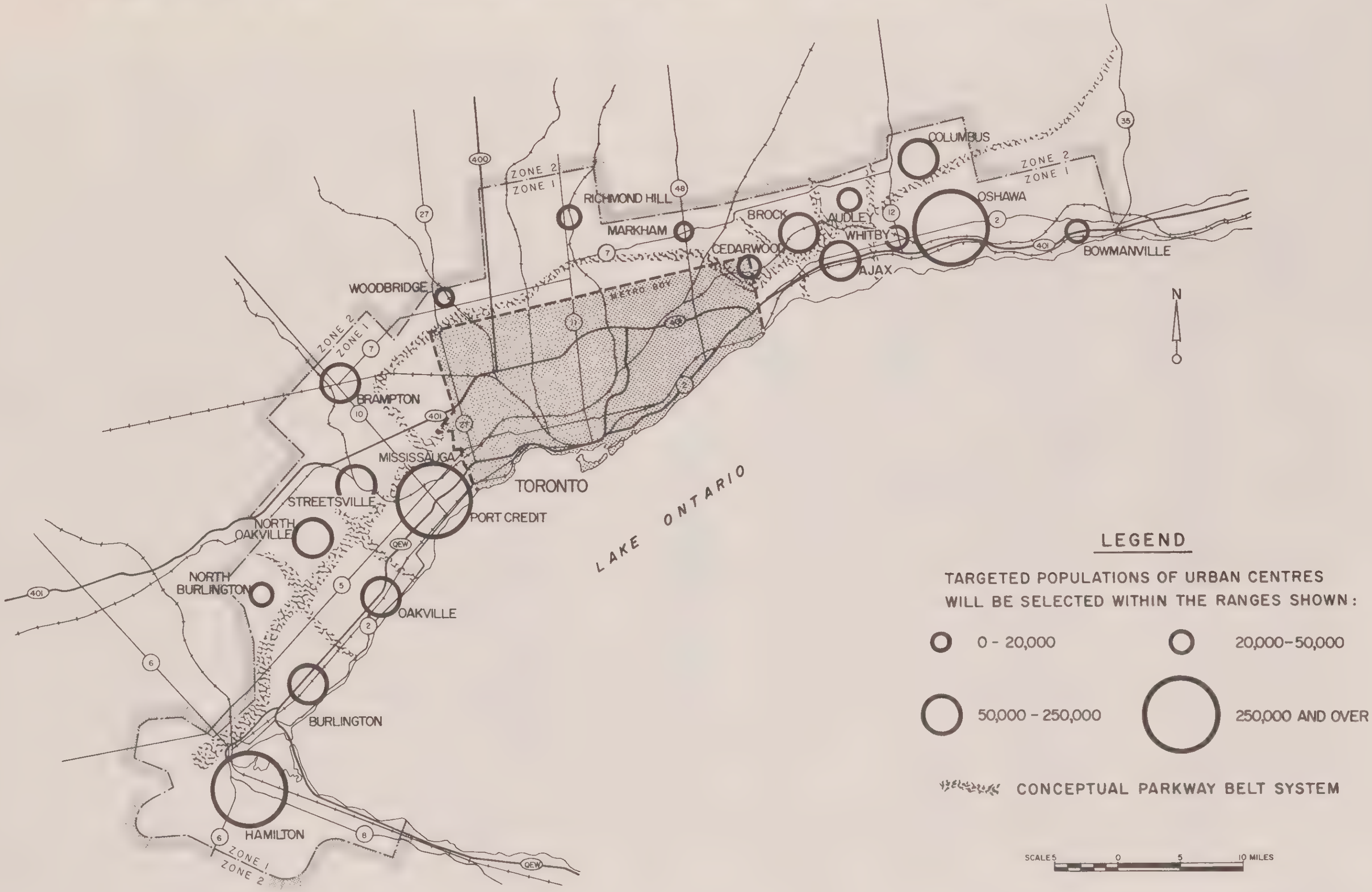
The area of the Toronto-Centred Region plan which is of primary concern to this commuter rail study relates mainly to Zone 1 although some rail lines under consideration penetrate the southern boundary of Zone 2. The Regional Development Branch was requested to comment on priorities for the development of commuter rail service within this area on the basis of the goals and objectives of the Toronto-Centred Region plan. A position paper was produced, dated September 1971, extracts from which follow and which can be related to Figure 4:

A. General Comments

> *Decentralization is the main theme.* To offset tendencies toward excessive concentration of activities and housing in Metropolitan Toronto, the plan aims to create several viable alternatives to a Toronto location for all but highest-order activities. There is no desire to downgrade Toronto. On the contrary, it is seen as performing increasingly specialized regional, provincial and national functions. These will be facilitated if the core and its approaches are relieved of excessive clutter by lower order economic activities and large daily tidal flows of people.
>
> *Simple linearity is the key.* The planned urban structure in the southern part of the region comprises a primary E-W urban axis, double-tiered, and a relatively minor N-S axis. Most centres of concentrated activity and majority of future residences will be aligned along or tributary to this simple well-connected linear structure. Additional centrally-focused corridors and massive inland development generally are being discouraged.

TORONTO COMMUTER RAIL STUDY

FIG. 4



TORONTO-CENTRED REGION

DEVELOPMENT CONCEPT FOR ZONE I

REGIONAL DEVELOPMENT BRANCH, DEPARTMENT OF TREASURY AND ECONOMICS   MAY 5, 1970

Handling of regional transit is critical. The implications for regional transit are favourable but require judicious handling:

a. A high proportion of longer trips in the heavy-demand designated corridors must be won to transit, by attractive combinations of feeder, line-haul and distribution services.

b. Facilitated by the linear development form, the number of distinct regional transit routes and their mileage is to be kept to a minimum, for highest possible system and market performance within the capital and operating resources available.

c. Transregion trips and reverse commuting should be facilitated. Services ideally should not be stub-ended in Toronto.

d. Services should not penetrate Zone 2.

e. Convergence of services at Toronto Centre is to be minimized or controlled.

f. Convergence of services at the eventual corridor outer terminals is to be actively sought.

B. Specific Comments

CNR Oshawa and Oakville Subdivisions. Expansion of the existing Lakeshore service would be consistent with the development aims of the Toronto-Centred Region Plan, provided it is not scheduled for in-bound commuter purposes exclusively. Reverse commuting services and express business services would assist the kind of developments in the corridor outer terminal cities, especially Oshawa, which are strategic objectives of the Plan.

CPR Galt Subdivision. This line is to be viewed in two sections. West of Streetsville, commuter service is to be avoided, for at least three reasons related to the Plan. First, the growth of Milton which might be stimulated in this way cannot be matched by sewer trunks from the lake except at disproportionate public cost. Second, an expanded Milton might jeopardize emergence of the key centres of the second-tier corridor of cities which are planned to be

serviced by sophisticated movement systems in the parkway belt (the belt will traverse the region roughly midway between Highway 401 and the lakeshore). Third, development pressures on open-space Zone 2 would be increased by commuter services laid along its lower edge, rather than in the centre of Zone 1...

East of Streetsville, rail service would have no adverse development effects, especially if centralizing influences are diluted by transfer arrangements at TTC Islington, and continuation of service across the region beyond either North Toronto (Summerhill) or Union Station.

CNR Weston and Malton Subdivisions.[1] Services should terminate at Brampton, if not still closer in. Georgetown is in TCR Zone 2, where the policy is for restrained development, not least due to excessive sewage disposal cost. Brampton is an expensive anomaly in the regional structure, and should be merely served, not stimulated. This suggests a special form of service whose calculated range of influence is short.

CPR Mactier Subdivision. Woodbridge marks the northern limit of massive urban development permitted under the Plan, and it is desired to minimize or eliminate development pressures beyond that point. Road service from Woodbridge feeding rail transit at Weston would appear to best meet this goal.

CNR Newmarket Subdivision and Bala Subdivision (2 lines). The TCR Plan, ... as far as northerly linkages are concerned, envisages only a modest suburban development corridor. This corridor should extend initially no further than Newmarket, due to the vulnerability of the catchment draining into Cook Bay and Lake Simcoe.

The suburban corridor function would be well served by modest use of either of these CNR lines. There should be articulation if possible with the outer end of the Spadina or Yonge rapid transit lines. Together with stops in key activity areas such as York University, this should help offset overcentralizing tendencies.

---

1. Subsequent to the position paper and during the course of this study, the Ontario Government re-assessed the need for commuter services in the north-west corridor and announced plans to introduce a limited GO Transit service to Georgetown as soon as possible.

CNR Uxbridge Subdivision.[1] Service should not extend into TCR Zone 2, that is not beyond Markham and desirably not beyond Steeles (Millikens) or even Agincourt. Weston-type service south of an interchange with CPR at Agincourt may be merited for the sake of TTC (Warden Subway) and GO Transit connections to a larger market of destinations than merely downtown Toronto.

CPR Havelock Subdivision.[1] In terms of its development effects, this service is entirely conformable (with the TCR-Plan) from Agincourt inwards. East of Agincourt the Oshawa Subdivision route via Malvern is more conformable with long-range intentions involving the eventual development of a northern tier of south-focused cities, as in the western corridor of TCR.

In summary, the comments received from the Regional Planning Branch with respect to the Toronto Centred Region plan indicate a preference for services that will not provide undue incentives for growth in a northerly direction (particularly in the Zone 2 region), and for services which would promote a second tier of development in an east-west direction. With respect to northern services, improving the accessibility of such centres as Barrie would be consistent with overall growth objectives if this could be accomplished without at the same time improving access to points between Toronto and Barrie. In short, as viewed from the perspectives of regional growth, a commuter service on the CN line terminating at Richmond Hill would be preferable to the CN line passing through Aurora-Newmarket. In the west, both the CN line to Brampton and the CP line to Streetsville would be encouraged. Development of the CP line easterly to Malvern would also be consistent with the objectives of the Toronto Centred Region plan, particularly

---

1. During the course of this study, the Federal Government announced plans to locate a second Toronto area major airport north of Pickering. This has raised additional possibilities for these lines in terms of serving the area to be influenced by the new airport.

if a through service were to be run to Streetsville using the North Toronto station rather than Union Station.

2. Ministry of Transportation and Communications

In addition to the usual responsibilities of a provincial highway department, the Ministry of Transportation and Communications also sponsors and administers the GO Transit commuter rail service described in the previous chapter. The goals and objectives of the GO Transit organization are described separately below.

Plans and programs of the MTC with respect to highways have obvious relevance to the planning of new commuter rail services, largely because of the need to properly integrate access facilities and services with station locations.

The existing network of major highway facilities within and immediately adjacent to Metropolitan Toronto is shown in Figure 5. Within Metro, the widening of Hwy. 401 and Hwy. 27 is now almost complete. Outside of Metropolitan Toronto, the Ministry plans to expand the regional highway network as shown in Figure 5. Highway 403 and highway 407 combined constitute part of the Parkway Belt system envisaged by the Toronto Centred Region plan. The announcement of a proposed second major Toronto airport has naturally raised some questions as to ground access and plans for highway development in that area are now receiving special consideration.

3. Toronto Transit Commission (TTC)

Commuter rail services should not be planned without an assessment of their impact on existing transit services and

TORONTO COMMUTER RAIL STUDY FIG. 5.

an assessment of the possible integration with existing and proposed public transit. In 1971, the TTC carried over 330 million passengers. The system has been designed specifically to feed the core of Toronto with subway routes which follow relatively high density corridors. Surface bus routes in outlying lower density areas act as feeders to the subway system. Existing streetcar routes continue to fulfill an intermediate capacity role along major downtown oriented routes other than those with subway service.

Relative to other North American cities, the TTC operation is considered to be highly successful both in terms of quality of service provided and the ability to maintain high use in the face of competition from the automobile. Of approximately 3.5 million daily person trips in Metropolitan Toronto, about 1.2 million are to and from work. The TTC attracts about 35% of these, although for downtown oriented work-trips, about 70% are handled by public transit.

Responding to this role, the TTC has devised a concept for future expansion of its system which is incorporated in a document released in February 1969, entitled *A Concept for Integrated Rapid Transit and Commuter Rail Systems in Metropolitan Toronto*. That concept, as shown in Figure 6, includes various alignments of inter-connecting subway, intermediate rapid transit and commuter rail systems. The plan also indicates additional services connecting the proposed waterfront and Toronto Island development, the Canadian National Exhibition, and the Toronto International Airport. Although the report stresses that the plan is strictly conceptual and that various alignments shown are only schematic, it does emphasize that the basic main subway lines are to be given higher priority than the intermediate radial and circumferential lines.

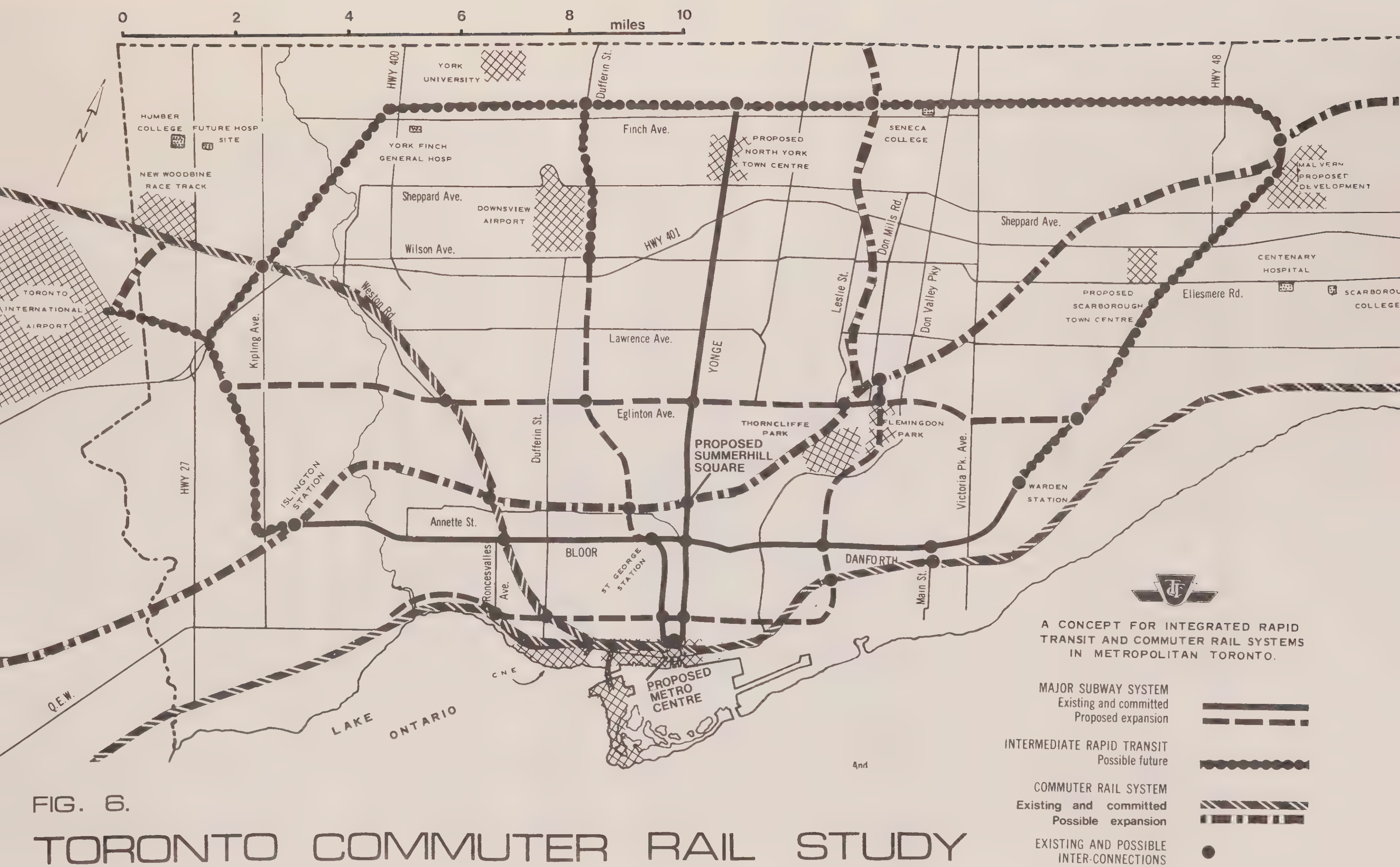


FIG. 6.

TORONTO COMMUTER RAIL STUDY

With reference to the proposed new commuter rail lines shown in Figure 6, it should be noted that no detailed planning or analysis was carried out prior to the release of the TTC Concept. For purposes of this study therefore, the suggested integration of new commuter rail lines with the rapid transit lines as indicated in the plan is more relevant than the actual choice of alignments.

4. GO Transit

As mentioned above, GO Transit is the responsibility of the Ontario Ministry of Transportation and Communications. In the report *GO Transit - Evaluation and Alternatives for Expansion*, issued in January 1969, planning objectives were defined in terms of three points:

(i) GO Transit should be planned as part of the overall future transportation requirements of the region.

(ii) This comprehensive transportation plan should be an integrated part of an overall development plan for the region.

(iii) Accepting the need for long-term planning, consideration should be given to public transportation modes other than those operating on railway-owned rights-of-way.

In the same report some analysis was made of the potential expansion of rail commuter operations along the various rail lines that exist within the area surrounding Toronto. In addition to possible extensions of the Lakeshore service, the following routes were considered:

- Union Station to Georgetown via CN Weston subdivision and Halton subdivision
- Union Station to Newmarket via CN Newmarket subdivision

- Union Station to Richmond Hill via CN Bala subdivision
- Union Station to Stouffville via CN Uxbridge subdivision
- Milton to Islington Subway Station via CP Galt subdivision
- Union Station to Locust Hill via CP Belleville subdivision.

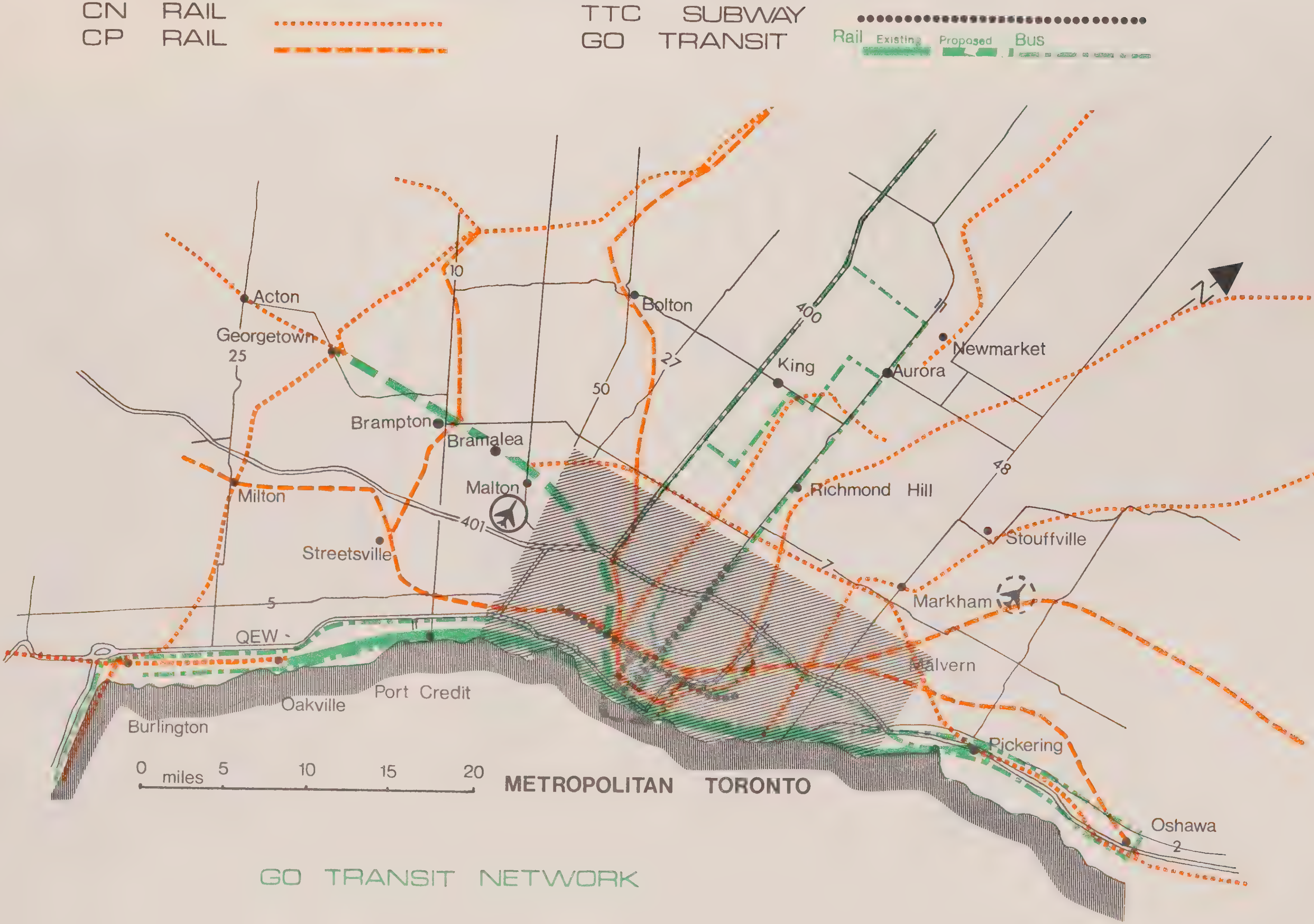
Subsequent to that report, the Lakeshore service was extended by providing express feeder buses between Oakville and Hamilton, and between Pickering and Oshawa, and GO Transit bus routes were introduced on routes to the north of Toronto, as shown in Figure 7. The major northern route provides 10 minute peak service and hourly off-peak service between Newmarket and Toronto via Highway 11 (Yonge Street). In addition, two buses per peak period run between Barrie and Toronto via Highway 400.

During the course of this study, the Ontario Government announced plans to implement GO Transit rail service between Union Station and Georgetown consisting of three trains per peak period. Rolling stock has already been ordered from Hawker-Siddley and service is expected to begin in late 1973. Most of the cost information shown in Chapter 5 for this line formed the basis for negotiations between the Ministry of Transportation and Communications and Canadian National.

5. Metropolitan Toronto Planning Board

The 28-member Metropolitan Toronto Planning Board is principally concerned with the Metropolitan or regional aspects of land use, ways of communication, sanitation, greenbelt and park areas and public transportation. The problems it attempts to resolve are primarily those associated with the urban core of the region for which Metropolitan Toronto is responsible to its member municipalities.

TORONTO COMMUTER RAIL STUDY FIG. 7.



GO TRANSIT NETWORK

In December 1966, the Board published for the Metropolitan Toronto Council, a document entitled *Metropolitan Plan for the Metropolitan Toronto Planning Area*. This was adopted by the Council not as an 'official plan' but as a "statement of the policy of the Metropolitan Corporation for the planning of future Metropolitan works and services and as a guide for future development in the Metropolitan Toronto Planning area".[1] Basically, the Metropolitan Plan embodies certain development aims by outlining the general land use and transportation pattern and the distribution of population in the context of defined development principles and policies. These factors are indicated on the Planning Board's map entitled "Development Plan - General Concept", shown in Figure 8, which has been taken from *Supplement to the Metropolitan Plan, 1966*. One of the transportation objectives listed in this *Supplement* was stated as follows:

> To provide for and ensure the effective integration of rail commuter system to connect outlying urban development and the areas beyond the Planning Area to the rapid transit system and to the central business district.

6. Canadian National Railways (CN)

The major change to the CN Toronto system in recent years involved the relocation of their freight classification yard from downtown Toronto to a location in the north-west quadrant of Highway 7 and Keele Street just south of Maple. The area from which the classification yard was moved is controlled by the Toronto Terminals Railway (TTR).[2] CP Rail

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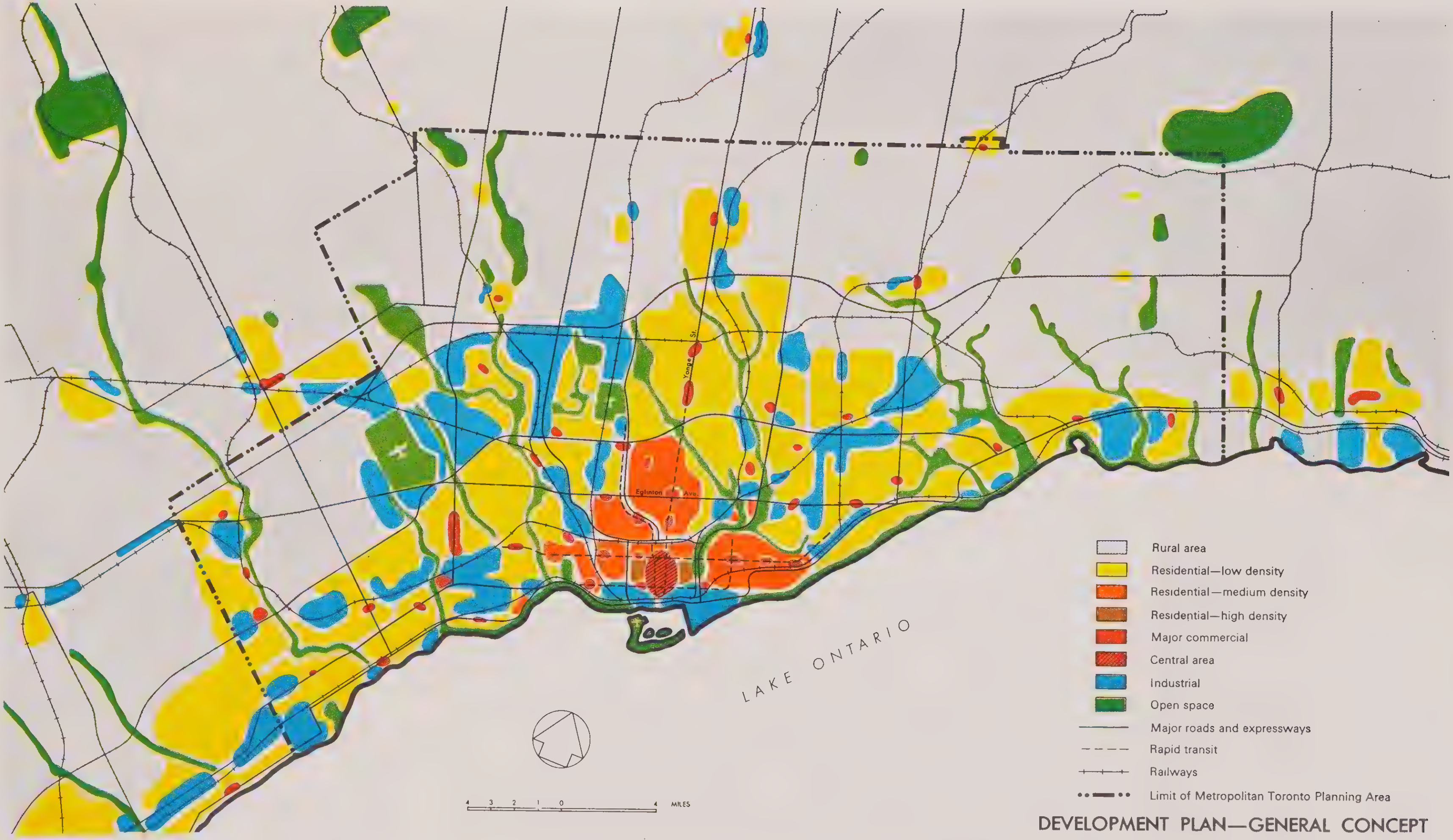
1. Extracted from Metropolitan Plan.

2. Toronto Terminals Railway is a company owned jointly by CN and CP which controls certain rail facilities within the approaches to and within Union Station.



TORONTO COMMUTER RAIL STUDY FIG. 8.

also relocated their classification yards with the result that there has been a substantial reduction of freight traffic on TTR property. These relocations created opportunities for redeveloping the old freight yards in downtown Toronto and Metro Centre Developments Ltd. was formed by CN and CP to manage the redevelopment of the 187 acre site.

The proposed Metro Centre development calls for a multi-purpose residential, commercial, transportation and communications complex. The transportation element consists of a transportation centre that would integrate subway, bus, commuter rail, and inter-city rail facilities. Dedicated tracks and platforms could be provided for commuter rail services. Since these would be used for commuter services only, the allocation of the associated costs would probably be directed entirely to the commuter rail spónsors.

After considerable public discussion and controversy, the Metro Centre concept has now been approved by the Ontario Municipal Board and plans to initiate the first phase are underway. The integration of existing and proposed new commuter rail services resulting from the Metro Centre plan is a special question which will now have to be treated by the affected agencies and organizations.

7. Canadian Pacific (CP)

In addition to their involvement in Metro Centre, CP is affected by another development proposed for the area currently known as the CP North Toronto Station. This station, no longer used for passenger purposes, is located at the intersection of the CP North Toronto subdivision and Yonge Street, adjacent to the Summerhill subway station. The residential-commercial complex, termed Summerhill Square, is under the management of Marathon Realty Company Ltd., an arm of Canadian Pacific Investments Ltd.

This development presents a unique opportunity to provide a second intermodal interface in the downtown area of Toronto. If a commuter rail service were to be instituted on the North Toronto subdivision, then an interchange facility could be incorporated with the Yonge subway line at Summerhill Square. Plans are currently being devised which could provide the flexibility for future inclusion of a commuter rail station within the development.

8. Federal Ministry of Transport

As indicated in Chapter 2, the Federal Government is indirectly involved in the provision of commuter rail services through subsidies paid to the railways for inter-city passenger trains that perform limited commuter functions. These subsidies are paid by the Canadian Transport Commission under subsection 261(4) of the Railway Act which authorizes the CTC to pay up to 80% of the certified losses on passenger train services. Under this subsection, passenger train services between Toronto and Guelph, Stouffville and Peterborough are subsidized. The GO Transit rail operation is a contracted service and as such is not eligible for subsidy under the Railway Act.

Commuter Services are specifically excluded from subsidy, but under subsection 261(9), the CTC may certify any actual loss sustained by a commuter service and report to the Governor in Council with recommendation to provide assistance in respect of such loss. This subsection of the Act has yet to be applied to a commuter service in Canada.

The Federal Government may also become indirectly involved in commuter rail services under Section 202 of the

Railway Act which provides funding for improvements and grade separation at highway-railway crossings from an account known as "The Railway Grade Crossing Fund". The funds currently available are limited and only a small proportion of applications receive assistance. Existing legislation limits the contribution per grade crossing to 60% of the cost or $300,000, whichever is lesser, for a new grade separation, or the lesser of 30% of the cost or $150,000 for an improvement of reconstruction of a grade separation. Funding is not applicable to major relocations of railway lines.

Revised legislation is pending[1] which will increase the available funds and the allowable amount per project, and permit contributions towards major railway line relocations. The introduction of commuter services on Toronto railway lines could require improvements to or new grade separations which would be eligible for funds under this section of the Act. However, such improvements would of course, be in competition with other applications from all across Canada.

One of the major Federal Government programs that does directly affect consideration of commuter rail services concerns the proposed second Toronto Airport (announced subsequent to the start of this study). The CP Havelock subdivision passes through the centre of the proposed site and the CN Uxbridge subdivision to Markham and Stouffville is relatively close to the new site, thereby making both lines candidates for ground access to the airport.[2] However, proposals

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1. The Minister of Transport and the Minister of State for Urban Affairs announced some of the details of the proposed legislation in a joint press release dated 10 October 1971.

2. Because this study was well under way when the airport announcement was made, airport access was not considered among the criteria used to choose lines for detailed analysis, as outlined in the following section.

concerning the use of either line should consider the special requirements for airport access such as non-stop service, baggage handling, and en route check-in facilities.

Even though the characteristics of airport access services and commuter rail services differ somewhat, it is quite possible that the requirements for both types of services may be complementary, each enforcing the feasibility of the other. In any case, the question of ground access to the new airport, both by highway and public transit, is now under study by a joint Federal-Provincial study team. The information provided in this report on the cost of providing commuter rail service on the CP main line should contribute substantially toward an assessment of the potential of this line for airport access as well.

Selection of the Basic Network

Chapter 2 identified ten railway lines which penetrate the downtown area of Toronto as shown in Figure 3 and on a larger scale, in Figure 9. Of these, two are already used for the GO Transit Lakeshore commuter service. Consequently, preliminary assessment was made of the remaining eight lines based on the previous studies by MTARTS and GO Transit and on the planning factors outlined in the previous section. On the basis of this preliminary assessment, four of the eight lines were considered to have greater potential and these were selected for more detailed analysis. The four remaining lines, namely the CN Newmarket, CN Uxbridge, CP Havelock and CP Mactier which were omitted from further study, are described briefly below.

TORONTO COMMUTER RAIL STUDY

FIG. 9 METRO TORONTO RAILWAY AND TRANSIT ROUTES

<u>CN Newmarket Subdivision</u> - This line follows a northerly direction from Toronto and passes through the towns of Maple, King, Aurora and Newmarket. From a regional planning point of view, this line penetrates well into Zone 2 of the Toronto Centred Region. Based on the regional planning criteria outlined in the previous section, frequent commuter service along this route would produce development pressures which are inconsistent with the guidelines for development in Zone 2.

With respect to local planning considerations, this line is parallel to and about one mile west of the proposed Spadina subway line in Metropolitan Toronto. The basic purpose of the Spadina subway route is to tap the residential areas in the north-westerly section of Metropolitan Toronto and to feed directly into the downtown subway routes. Commuter rail service on this line would therefore duplicate the function of the proposed new subway line.

In addition, there are significant physical limitations on this line. It is unsignalized and consists of a single track on a narrow right-of-way. The concentration of industry south of Highway 401 generates numerous switching movements which place severe limitations on providing additional line capacity. Frequent commuter service would require widening of the right-of-way and relocation of industry or the construction of an elevated rail line for the exclusive use of such a service. This could only be accomplished at considerable expense. At some point in the future, however, this line might be a suitable candidate for some form of intermediate capacity technology.

<u>CN Uxbridge Subdivision</u> - This line also follows a northerly route and passes through the towns of Unionville, Markham and Stouffville. Comments concerning the Newmarket subdivision with respect to regional planning objectives apply to this line as well since extensions beyond Steeles Avenue would lie well within Zone 2. However, as noted previously, the transportation requirements for this area are being re-evaluated in view of the proposed second Toronto airport in Pickering. Studies now underway by the Federal and Provincial governments may affect development policies for this area. In addition, the Regional Municipality of York has recently doubled the population targets established in the Toronto Centred Region plan for some of the towns in this area, and these targets have apparently been approved by the Regional Planning Branch.

Within Metropolitan Toronto, the southerly section of this line passes through an area in Scarborough now served fairly well by the existing GO Transit service and TTC surface routes which connect with the subway at St. Clair Avenue and Warden Avenue.

This line is also single track, unsignalized, and on a narrow right-of-way. Existing traffic consists of a daily passenger train return service serving Stouffville, Markham and Agincourt. Freight services are limited to industrial switchers which serve several small but growing industrial areas.

One of the major obstacles to a frequent commuter service concerns grade crossings. The single track line crosses all east-west roads at grade including the major traffic arteries such as Danforth Road, Eglinton, Lawrence, Ellesmere, Sheppard and Finch. Apart from the safety aspects, frequent train service would produce disruption to road traffic expected to grow significantly in the near future.

Grade separations would involve a substantial expenditure. In addition, this line joins the CN Kingston subdivision at the Scarborough GO Transit station and any increased service would pose capacity problems on the existing GO Transit lakeshore route between Scarborough and Union Station.

<u>CP Havelock Subdivision</u> - The CP Havelock and Belleville subdivisions join at Agincourt to become the main CP line through Toronto. West of Agincourt, the line is one of those to receive detailed consideration. East of Agincourt, the Belleville subdivision to Malvern accommodates regional planning objectives and conforms to long-range intentions involving the eventual development of a northern tier of south-focused cities. Consequently, the Havelock subdivision was eliminated from further consideration as a commuter rail service (to be distinguished from the longer services to Peterborough and Havelock).

<u>CP Mactier Subdivision</u> - This line runs parallel to the CN Weston subdivision from Toronto Union to just north of Weston and then proceeds northerly to Woodbridge. Since the CN Georgetown service would satisfy the commuter market around Weston, potential service on the Mactier was considered on the basis of its possible contribution to the Toronto Centred Region plan beyond the limits of Metropolitan Toronto.

According to the regional planning criteria prepared for this study, it is desirable to minimize or eliminate development pressures beyond Woodbridge, which marks the northern limit of massive urban development permitted under the TCR. It was suggested that this could be achieved by a road service from Woodbridge feeding rail transit at Weston.

With the elimination of the four lines described above, a basic network of rail lines remained for further detailed analysis. The basic components of this network are as follows:

CN Weston and Halton subdivisions
CN Bala subdivision
CP Belleville subdivision
CP Galt subdivision.

The CN routes both run through Union Station in downtown Toronto. Two options were specified as the downtown route for the CP lines, one via the North Toronto Station, the other via Union Station. These lines have been selected primarily on the basis of their consistency with local and regional planning goals and their suitability with respect to railway operations and existing physical railway plant.

Selection of Stations

The choice of station locations was based on a combination of planning factors and railway operating constraints. Some of the major factors taken into account include the following:

1. proximity to population centres or well defined community catchment areas
2. proximity to major arterials or expressways

3. minimum spacing of 2 miles
4. access for buses and automobiles
5. availability of non-developed land for parking lots (especially in areas outside of Metropolitan Toronto)
6. possible connection with subway system (see Figure 9)
7. possible integration with TTC surface routes
8. suitability of track layout for provision of an 850 ft. platform
9. remoteness from industrial railway sidings
10. existence of present station sites and their use by existing railway patrons
11. adequate distance from residential areas in order to minimize effects of noise caused by traffic oriented to the station, and by train deceleration and acceleration.
12. existing and proposed track signal layout with respect to switches, cross-overs, etc., designed for other rail traffic.

Final station locations were determined through an iterative process in which suggestions made by staff of Metro and Provincial planning agencies were tested against railway operating and design criteria. This led to the following list of stations for each line in the basic network (as shown in figure 10).

<u>Union to Georgetown Route</u> (CN Weston and Halton Subdivisions)

Union Station
Bloor (TTC Subway interchange at Dundas West)
Weston
Rexdale
Malton
Bramalea
Brampton
Georgetown

TORONTO COMMUTER RAIL STUDY FIG.10

RAIL LINES STUDIED AND STATION LOCATIONS

<u>Union-Richmond Hill Route</u> (CN Bala Subdivision)

Union Station
York Mills
Finch
Thornlea
Richmond Hill

<u>Streetsville to Malvern via North Toronto</u> (CP Belleville, Galt and North Toronto Subdivisions)

Streetsville
Erindale
Cooksville
Dixie
Islington (TTC Subway interchange)
Spadina (TTC Subway interchange)
Summerhill (TTC Subway interchange)
Leaside
Don Mills
Victoria Park
Agincourt
Malvern

<u>Streetsville to Malvern via Union Station</u>

Same stations as for route via North Toronto but Spadina and Summerhill are replaced by Bloor and Union Station.

In many cases a number of alternative station locations are possible and precise station locations would have to be considered in greater detail during the final planning stage for any new services. Different station locations would, of course, have some effect on patronage. However, since the rail lines under study follow more or less well defined development corridors, the total demand potential that could be estimated with a different set of station locations would probably not differ significantly from the patronage estimates produced for this study. Similarly, cost estimates would be affected, but here again, differences in total system costs should not be significant.

Chapter 4

DEMAND ANALYSIS

Introduction

Patronage estimates are obviously the single most important factor to be considered in evaluating the viability of new commuter rail services. If the demand does not exist, or if the service is not sufficiently competitive with other forms of transportation to attract passengers, the service will be inefficient, however low the cost. Moreover, in the event decisions are taken to introduce new commuter rail services, patronage estimates are critical in establishing schedules, frequency of service, and rolling stock requirements. This chapter describes the patronage forecasts which were made for the basic network of commuter rail facilities identified in the preceding chapter.

Nature of the Commuter Rail Market

A mix of transportation modes is generally available to serve travel needs in a large urban area. Some modes are more suitable than others for certain types of trip. Automobiles, for example, have obvious advantages for most social and recreational trips whereas public transit may be preferred for many home to work trips in densely developed areas.

Commuter rail services are characterized by long distances, relatively few stops between terminals (compared to surface transit or subways), and considerable dependence on published schedules. As a result, they are particularly

suited to longer trips between suburban areas and highly concentrated activity centres, and may offer significant travel time advantages over other forms of transportation for those trip makers whose origins and destinations are reasonably convenient to stations at both ends of the line. The "schedule-dependence" of commuter rail services also makes them well suited to trips which are made on a regular basis, such as the journey to work. These characteristics are illustrated by the data of Table 4.1, based on surveys carried out between 1967 and 1971 on the existing GO Transit Lakeshore service.

A number of factors influence a person's choice of travel mode for a particular trip, some of which relate to the characteristics of the trip maker, others to the characteristics of the transportation system. (The process by which modal choice is estimated is referred to as "modal split" analysis). Some of the more important system characteristics which influence modal choice and which should therefore be taken into account both in the evaluation and design of new commuter rail services include the following:

1. Travel Time

   In order to compete effectively with the automobile, commuter rail service must reduce travel time by minimizing the number of stations in suburban areas and by operating non-stop for considerable distances in the most congested sections of the central city. Because total time from door to door influences modal choice, consideration of en route commuter train time cannot be divorced from access and station waiting times, which are discussed below.

Table 4.1

Selected Characteristics of GO Transit Users

1. Trip Purpose[1]	
Work trips	85%
All other purposes (business, shop, school, social, etc.)	15%
2. Downtown Orientation (A.M. Peak)[2]	
Total station exits at Union	95%
Total exits at all other stations	5%
3. Access Mode at Downtown End of Trip[3]	
Walk from station	65%
Subway	33%
Other	2%
4. Time of Day	
GO passengers 6-9 A.M. and 4-7 P.M.	75%
All other times	25%

1. GO Transit, Report C4, June 1969.
2. 1971 counts.
3. GO Transit, Report Cl, June 1968.

2. Access Convenience

   The proximity of potential commuter rail users to stations and the means of access markedly affect their choice of travel mode to the central area. Those within walking distance of a station at both ends of the trip are most likely to use the service. At downtown stations it is important to provide easy transfer to the city transit system for collection and distribution of passengers who are not within walking distance of the railway station. In suburban areas, patronage will be influenced by the ease of automobile access, the availability of parking, and the existence of surface transit following fixed routes or dial-a-bus offering home to station service on demand.

3. Train Frequency and Schedule

   Waiting times at stations will affect overall travel time and the perceived convenience of the service. As headways between trains are reduced waiting times will be reduced and there will be greater freedom from schedules. More frequent service also allows for a better matching of preferred arrival times at the destination. Off-peak service further improves convenience and offers greater flexibility from the point of view of the travellers.

4. Reliability

   Travellers normally allow some time in their travel plans to account for unforseen delays. Reducing this contingency time increases the attractiveness of a service. Important features of a commuter rail service therefore include on-time performance, assured service during adverse weather, and freedom from congestion associated with other modes.

5. Comfort

   Availability of seats, rail car appointments, station facilities for protection from the weather, and ease of transfer to other modes are all factors which affect the attractiveness of commuter rail services.

6. Fares

   Fares charged for the commuter rail services will obviously affect patronage. In general, fare policy should be consistent with policies adopted for other

forms of public transit although in some cases, other planning objectives may dictate preferential treatment for one mode or another.

7. Downtown Parking

   An important influence on choice of travel mode is the availability and cost of downtown parking. In downtown Toronto, limited parking is available at reasonable rates, but as surface lots are being absorbed by development, parking charges are rising sharply. The incidence of parking costs is also critical. Many of those who presently park downtown are subsidized by employers, thereby artificially increasing the proportion of travellers who choose the automobile mode.

Other considerations influence modal choice as well, such as the degree of privacy inherent to the use of certain modes, ease of use by handicapped persons, availability of parcel or baggage racks, and possibly even the fare collection system (particularly in cases where "exact fares" are required). The effect of all of these factors on modal choice will depend upon the range of available alternatives and the particular circumstances of the potential trip maker such as his income and occupation, the purpose of the trip, and whether there are special requirements to carry goods or tools or to travel in the company of others.

Basis of Demand Estimates

Some of the factors discussed above have been taken into account explicitly in the modal split technique used to make estimates of commuter rail passenger demand in this study. Two steps were necessary to estimate the magnitude of travel demand at any point in time. First, basic estimates of the total movement of persons between each area and every other area were made, known as total

person trip origins and destinations (O-D). Second, O-D pairs of interest were split into those that would use commuter rail and those that would use other modes (modal split analysis).

The basic demand estimates were prepared by the Systems Planning Branch of the Ontario Ministry of Transportation and Communications (MTC) with the use of a simulation model developed over the last several years and employed in other studies of the Toronto region.[1] With the co-operation of MTC, the firm of Transportation Systems Associates refined the initial estimates to derive the final estimates discussed in this chapter. The particular modal split technique used with this model was "calibrated" for today's situation on the basis of known factors with respect to the GO Transit Lakeshore corridor.

Total person trip O-D's were estimated for an average workday condition in 1969 and 1976, the years for which the necessary input data were available. For the modal split analysis, trips between the central area and the commutersheds adjacent to commuter rail stations were extracted from the total matrix of O-D movements. The modal split technique was then used to estimate the number of trips expected to use commuter rail for each particular system being tested.

Patronage estimates were made for the systems

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1. The 'TARMS' or Toronto Area and Region Model Study.

shown schematically in Figure 11[1]. Each line in a system was assumed to provide a level of service equal to that presently offered on the GO Transit Lakeshore route, i.e. 5 to 6 peak trains with 20 minute frequency, five days a week and 1-hour headways off-peak, weekends and holidays; free parking provided at suburban stations; same basic fare structure, and so on. Since it is impossible to determine exactly what conditions might prevail in the future, the estimates were prepared for a range of conditions in terms of area served by a given commuter service, and travel speeds on the road system.

"Catchment" areas were established for each station along each railway route in terms of the minimum and maximum area served by a commuter rail service in that corridor. Estimates of demand were prepared for each of these situations in 1969 and 1976. Furthermore, for 1976 an increase in road travel time in the peak hours of 25% over that which exists today was assumed in a separate calculation of demand in order to assess the effects of increasing congestion.

In total therefore, five situations were analyzed

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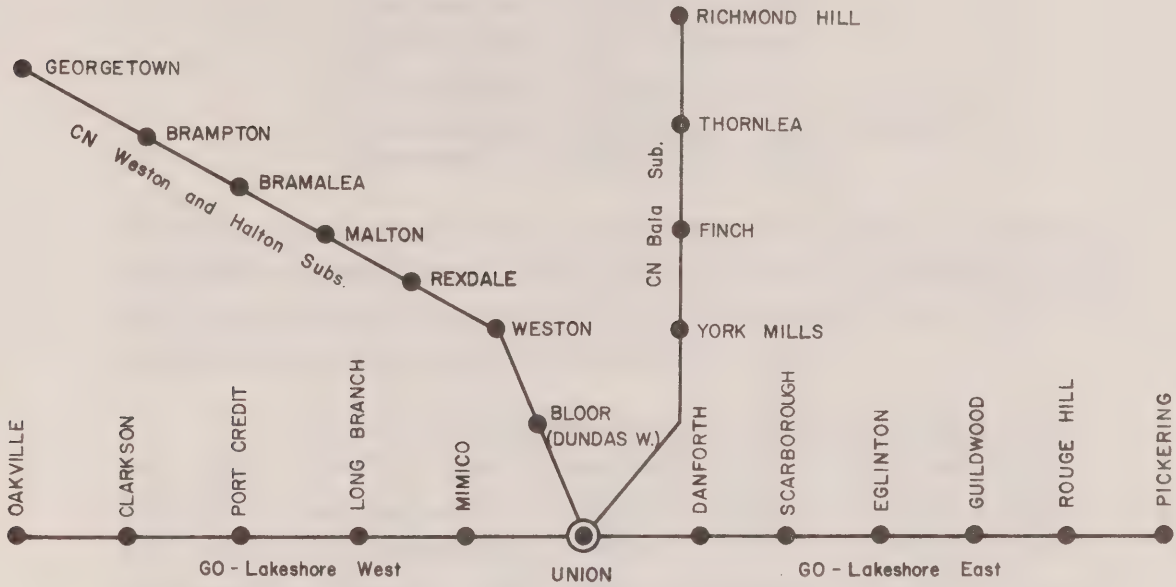
1. Patronage estimates were also obtained for the CN Newmarket subdivision as far as Newmarket and for the CN Uxbridge subdivision as far as Stouffville but they have not been included here. Considerable overlap was found between the market areas of the Newmarket subdivision and the CN Bala subdivision and between the market areas of the Uxbridge subdivision and the CP Belleville subdivision. Furthermore, cost estimates were not obtained on the Newmarket and Uxbridge subdivisions and consequently the potential of these lines with respect to supply and demand could not be assessed in relation to other lines considered.

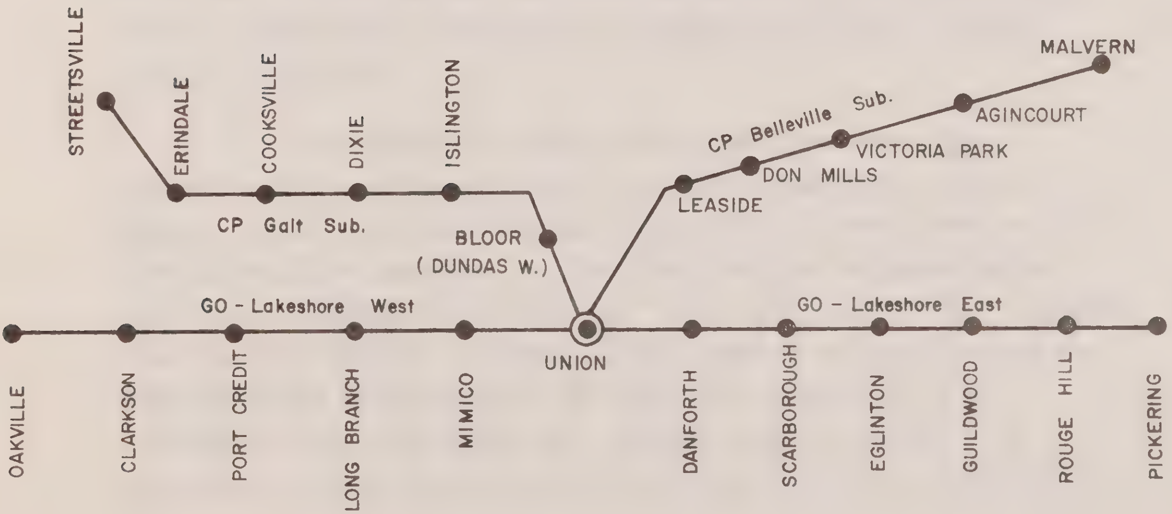
TORONTO COMMUTER RAIL STUDY

SCHEMATIC DIAGRAMS OF RAIL NETWORKS TESTED IN DEMAND ANALYSIS

FIG. 11.



(a) GEORGETOWN — RICHMOND HILL WITH EXISTING GO TRANSIT



(b.) STREETSVILLE — MALVERN WITH EXISTING GO TRANSIT

for commuter rail demand:

1. 1969 minimum catchment area
2. 1969 maximum catchment area
3. 1976 minimum catchment area
4. 1976 maximum catchment area
5. 1976 maximum catchment area assuming 25% increase in road travel time.

Using the modal split analysis results for these situations, patronage estimates for 1972 were obtained by interpolation. This year was selected as it is the base year for which the subsequent cost analysis was carried out.

The basic results were also used to obtain estimates for 5 and 10 year increments, namely 1977 and 1982. Population estimates for 1980 were applied to each catchment area and these were used as a guide to estimate the increase in commuter rail traffic relative to 1976. The 1977 estimate was then obtained by interpolation between 1976 and 1980, the 1982 estimate by extrapolation beyond 1980. The difference between total passenger demand in 1976 and 1982 obtained in this manner compared favourably against projected increases in employment in the central area of Toronto.

It should be noted that these forecasts are based on the assumption that certain fundamental travel habits would not change over the next ten years even though there would be changes in the distribution of population and jobs throughout the region. For example, it was assumed that travel habits in terms of the number of work trips per week and the distribution of different types of trips throughout the day would not change significantly. In addition, it was assumed that there would be no substantial

change in the method of operating the overall transportation system with respect to the provision and pricing of downtown parking or the provision of such specialized services as dial-a-bus pick-up and distribution systems.

Introduction of a shorter work week and staggering of working hours would tend to reduce the demand for commuter rail service. On the other hand, introduction of extensive dial-a-bus services or the establishment of policies resulting in higher parking rates in downtown Toronto would tend to increase commuter rail usage. The firm of Kates, Peat, Marwick and Co., provided an assessment of the potential increase in demand that could be affected by these factors. Their appraisal of the dial-a-bus experiment at the Pickering GO Transit station indicated that *isolated* applications of Demand Responsive Bus feeder services would probably result in only minor increases in rail patronage. It is possible, however, that *extensive* application of such feeder services could result in a significant increase in commuter rail ridership because of the improved facility for door-to-door movements between many pairs of activity centres. The market penetration which might be achieved through such a high quality transit system could only be established through a large scale demonstration program.

The work undertaken by Kates, Peat, Marwick also indicated that a conscious public policy aimed at a major increase in downtown parking costs could result in an increase of commuter rail patronage in the order of 20 per cent above the ridership levels that would normally be projected for rail services. The critical element here,

however, is not so much to increase parking charges as it is ensure that the individual whose parking may now be subsidized actually pays the economic rate from his own pocket. Since a very large proportion of those parking downtown have their parking provided free or at highly subsidized rates by their employers, policies designed to shift the burden of parking costs directly to the user might have an even greater effect on commuter rail ridership than the 20 per cent estimated by Kates, Peat, Marwick.

It is unlikely that a major change in parking policy could be accomplished over the short term, although it may be practicable as a long term goal. Improving the public's perception of the actual economic costs of travel by transit versus travel by auto through a program of public information, might achieve some of the same results in the short term.

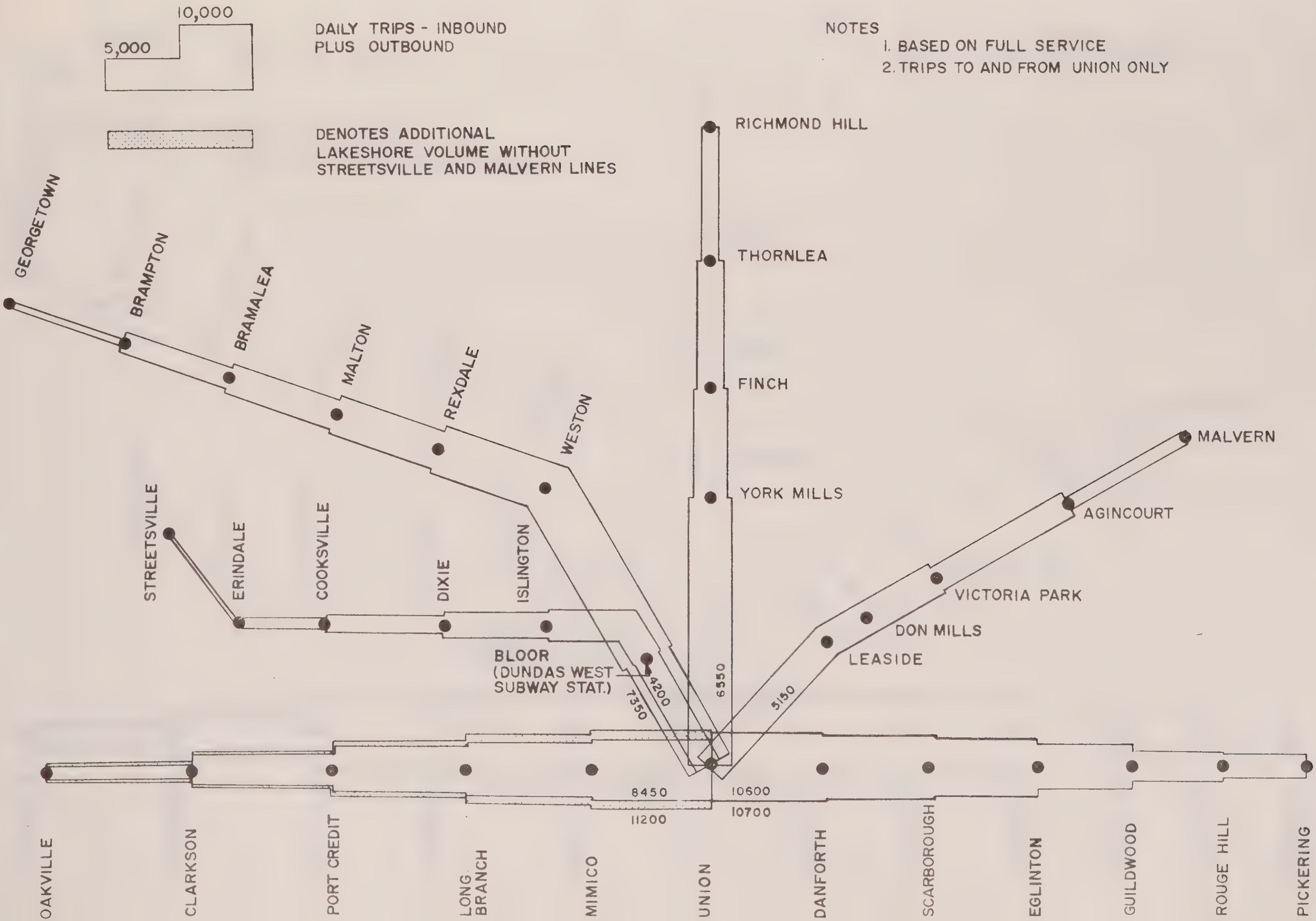
Since modal choice depends upon the available alternatives, the road and public transit networks as they are foreseen to exist in 1976 were assumed in the modal split analysis. The road network used for the 1976 simulation is the same as the existing network except for a minor alteration concerning an increase in capacity of Highway 427. The transit network includes the addition of the Yonge Street subway extension from Eglinton Avenue to Finch Avenue and the Spadina subway from St. George station to Wilson Avenue.

Travel Demand Results

Figures 12 to 14 show passenger flows predicted for an average weekday in 1972, 1977 and 1982. Each figure

TORONTO COMMUTER RAIL STUDY FIG. 12.

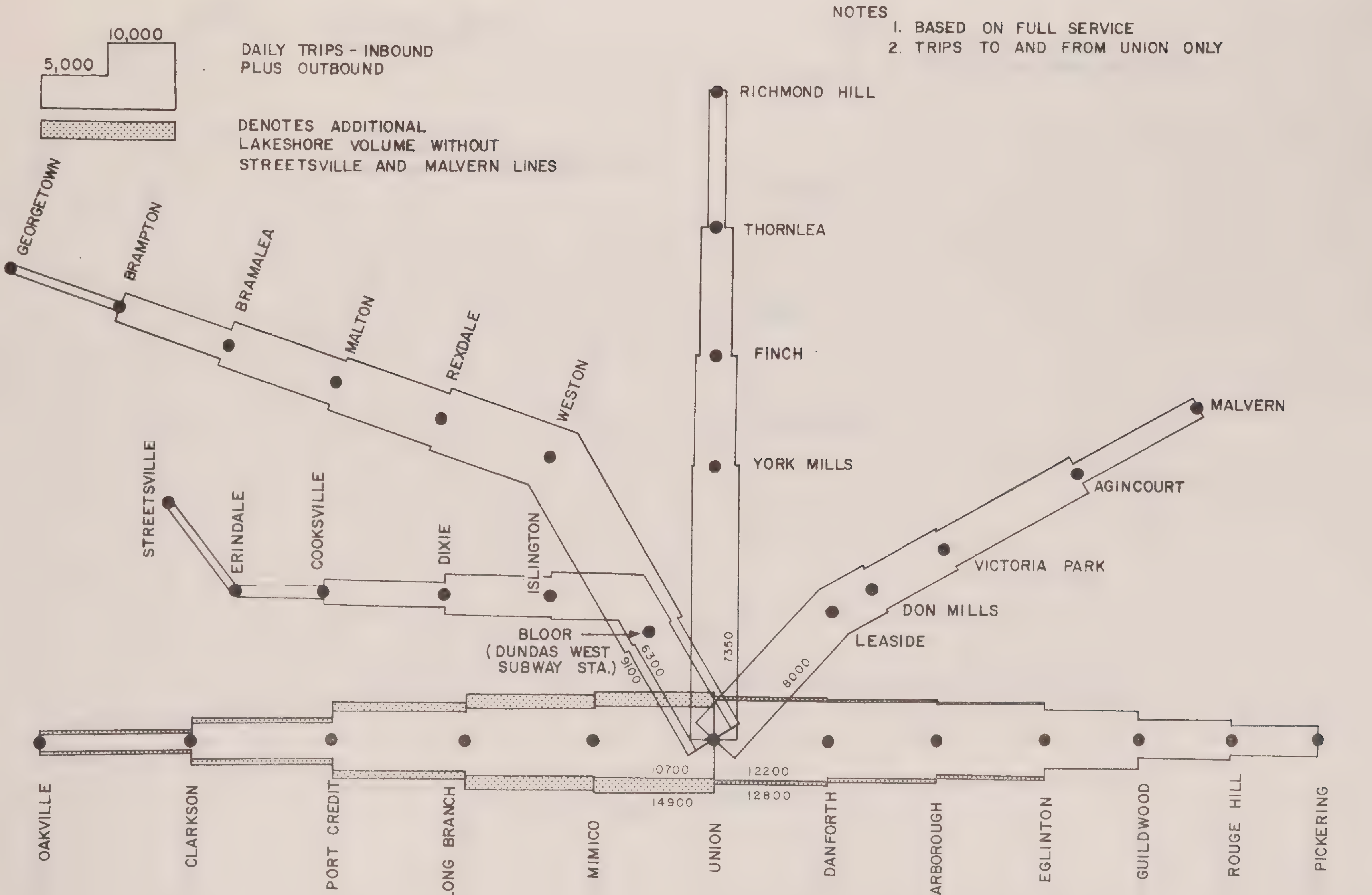
1972 DEMAND ESTIMATES



TORONTO COMMUTER RAIL STUDY

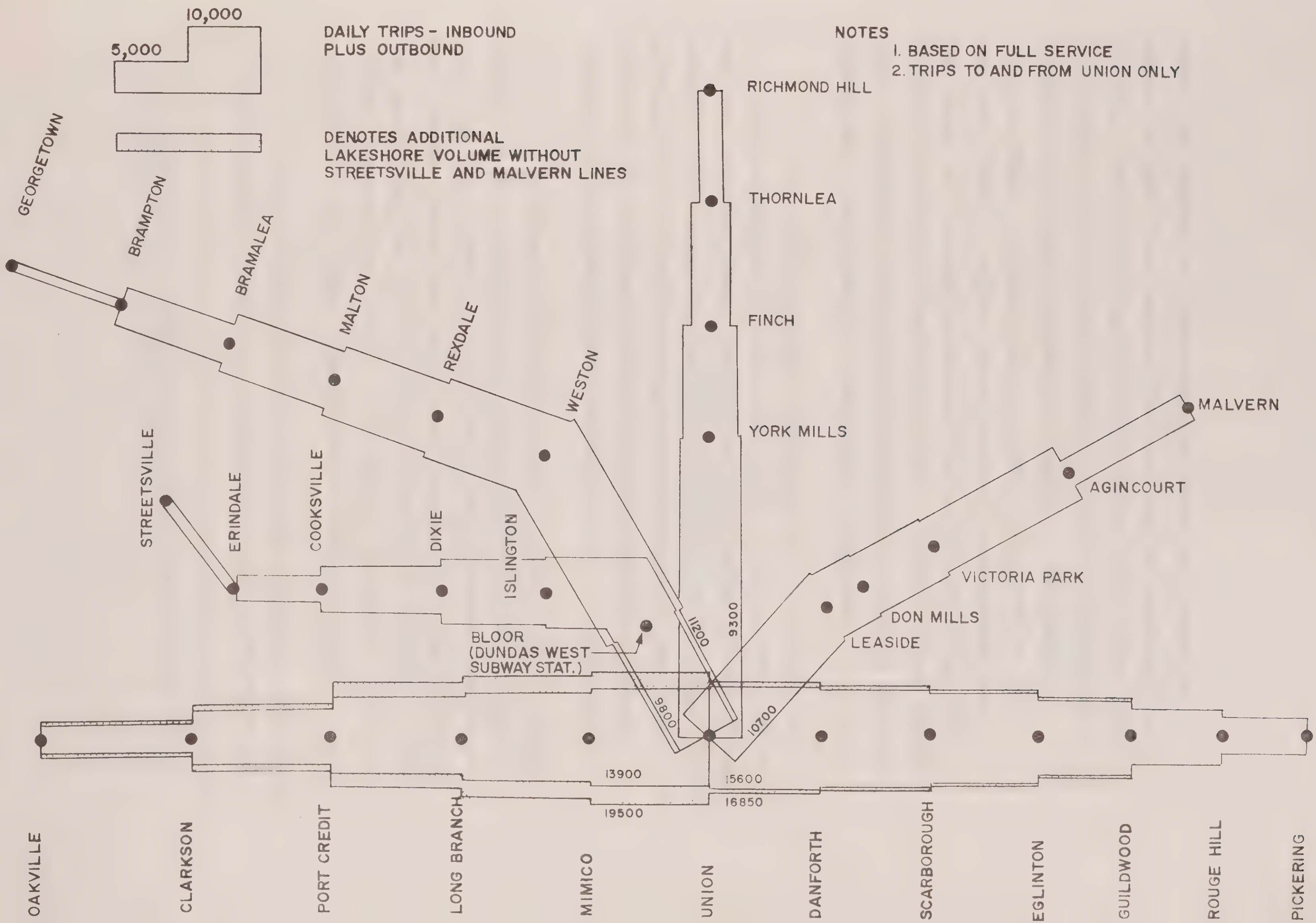
FIG. 13.

1977 DEMAND ESTIMATES



TORONTO COMMUTER RAIL STUDY FIG. 14.

1982 DEMAND ESTIMATES



shows the number of suburban residents estimated to travel to and from central Toronto on the commuter rail service. Trips between stations other than Union are not shown since they are predicted to be a very small proportion of total passenger demand.[1] The daily volumes shown on these figures are considered to be the most likely values after careful interpretation of the range of volumes produced from a consideration of minimum and maximum catchment areas. Where lines intercept the subway system (see Figure 9), transfers to the subway are indicated by a decrease in volume.

The flow diagrams indicate that the majority of trips originate at the outer ends of the lines. Except for the Malvern line, stations within Metropolitan Toronto attract relatively low patronage because of the competition provided by the Toronto Transit Commission's services. In the case of stations at Malvern and Agincourt, transit service to downtown Toronto would not be as competitive.

Patronage estimates shown in the flow diagrams appear to be consistent with projected changes in population and employment. The relationship between downtown employment growth and growth of residential population in the areas outside of Metropolitan Toronto results in increased demand over time. The rate of growth is fairly uniform for all lines considered in the analysis.

The volumes shown in the flow diagrams are based on full service operation (comparable to the existing GO

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1. As indicated in Table 4.1, approximately 95% of all passengers exit at Union Station.

Transit service). They would be reduced substantially for limited service operation. In addition, the forecasting technique was essentially insensitive to changes in downtown parking policy, the availability of feeder services, and fare levels, all of which could obviously have significant impact on the use of new services. However, in view of the short term nature of the estimates, they may be considered reasonable if it is recognized that changes in these factors will occur gradually, if at all. Within the limitations on the forecasting technique, the variance in estimated volumes for the maximum load points is expected to be about ± 25%.

Considering the existing GO Transit service along the Lakeshore as two lines emanating from Union Station, six lines were considered as part of the demand analysis. While these lines are basically independent, there would be some degree of competition among the lines if service were to be instituted on all of them. What the patronage forecasts show is that the Richmond Hill and Georgetown routes do not appear to interact with any of the other lines with respect to potential demand. However, there is considerable interaction between the Streetsville line and the existing GO Transit service on Lakeshore West, resulting in a reduction in volume on the latter. This reduction is indicated by the shaded portion shown in Figures 12 to 14. To some extent, there is limited interaction between the Malvern route and Lakeshort East.

The interaction between the Streetsville and Lakeshore West routes depends to a very great extent on whether Union Station or the North Toronto Station at Summerhill is selected as the downtown terminal for the

CP service. The patronage forecasts shown in Figures 12 to 14 were based on the assumption that the Streetsville route would terminate at Union Station with a resulting decline in Lakeshore West volumes of about 25 to 30%. The reason for this shift is simply that some of those riders now using the Lakeshore West line would find the Streetsville line more convenient, so long as both lines terminate at Union Station. If however, the North Toronto route were used, persons destined for downtown Toronto would be forced to transfer to the Yonge Street subway[1] which is already congested during peak periods. The incentive to use the Streetsville line would therefore be reduced.

Aside from the potential traffic diverted from Lakeshore West, some new traffic would be generated by the introduction of a Streetsville line (i.e. traffic that now uses some other form of transit or automobile). The extent to which this traffic would be sensitive to the choice of downtown terminal has not been analyzed, although presumably the Union Station alternative would be preferred. There would, of course, be some traffic for which the North Toronto terminal would be preferable, particularly if the ultimate destination was to the north and would therefore involve using the Yonge Street subway "against the traffic".

The effect of the North Toronto terminal on the eastern half of the CP line (to Malvern) would be less pronounced, largely because the Malvern and Lakeshore East

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1. Passengers would also have the option of transferring at the Spadina Station of the proposed new subway. However, because patronage forecasts were not made for the CP route via North Toronto, there is no basis for assessing the distribution of traffic between the two possible transfer points.

lines are further apart than their counterparts in the west. The Malvern line taps a potential market north of Highway 401 which is not now served by high performance transit. Most of the transit market would therefore be "captive" with respect to alternative transit (although even here the choice of a downtown terminal would have some effect on potential patronage).

While actual forecasts were not made to measure the effect of this choice in downtown terminal, some attempt has been made to describe the effect on patronage estimates of moving the downtown terminal for the Streetsville and Malvern routes to the North Toronto location, based on the following assumptions:

1. For Lakeshore West, 70 percent of the shift to Streetsville is assumed to return to Lakeshore West when the Streetsville service is routed via North Toronto. In addition 50 percent of the newly generated traffic for the Streetsville route is assumed to be lost.

2. For Lakeshore East, 25 percent of the shift to Malvern is assumed to return to Lakeshore East when the Malvern service is routed via North Toronto. Of the newly generated traffic, 20 percent is assumed to be lost by this relocation.

The effect of shifting the downtown terminal for the CP line on the heaviest link volumes for each of the six lines is shown in the bar diagram of Figure 15. Shaded bars represent forecasts with a downtown location at Union Station whereas the clear bars represent estimates for the North Toronto location. As discussed, the effects are greatest on the western portion of the CP line. This is indicated by the severe drop in patronage on Streetsville and the large increase on Lakeshore West, causing the latter to surpass Lakeshore East and in fact exceed the

TORONTO COMMUTER RAIL STUDY

DEMAND ESTIMATES – HEAVIEST LINK VOLUMES (100'S)

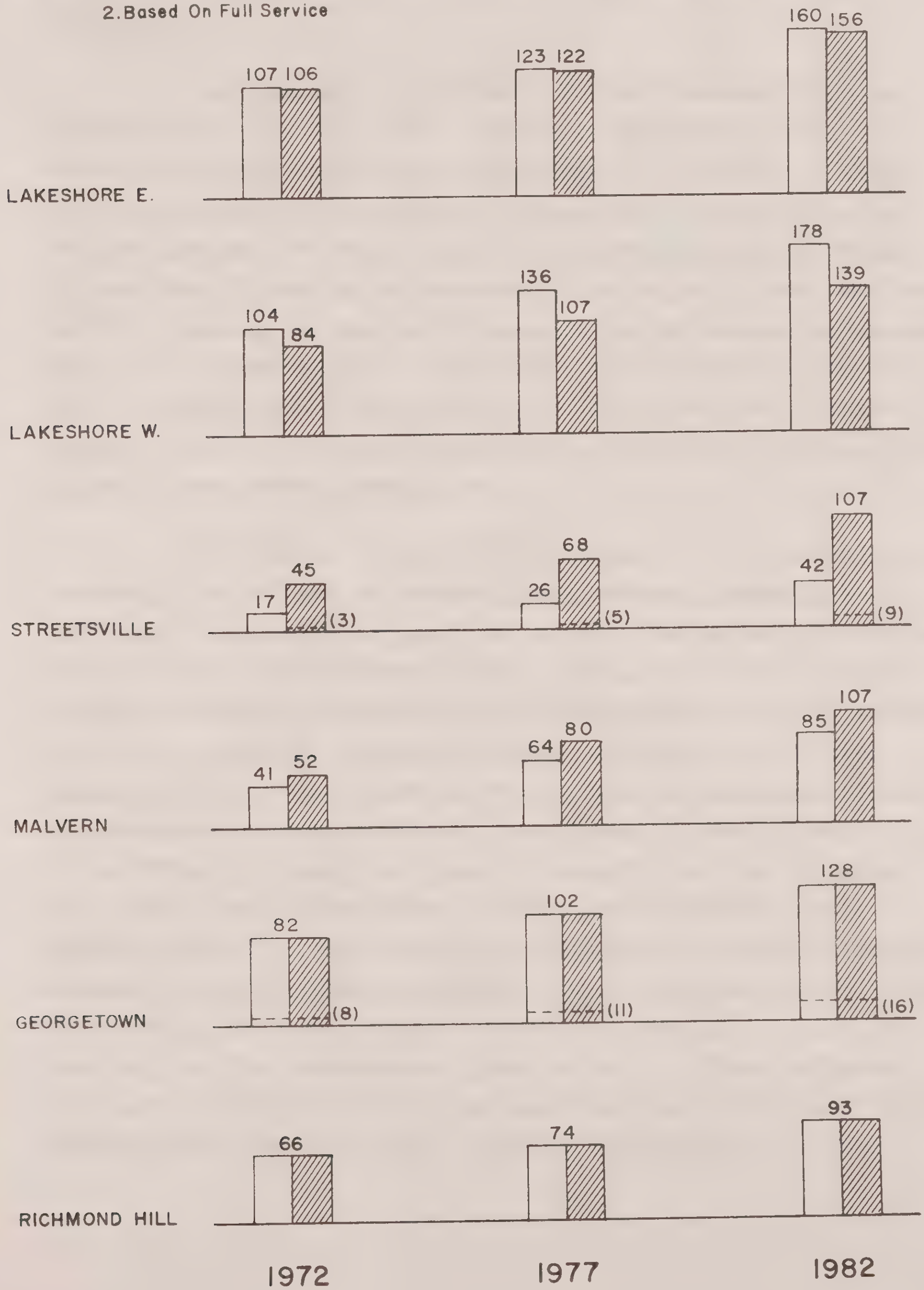
FIG. 15

STREETSVILLE AND MALVERN SERVICES VIA NORTH TORONTO AND EFFECT ON OTHER LINES

STREETSVILLE AND MALVERN SERVICES VIA UNION STATION AND EFFECT ON OTHER LINES

---( ) DENOTES TRANSFERS TO BLOOR SUBWAY

NOTES 1. Daily Trips - Inbound Plus Outbound
2. Based On Full Service



capacity of the line. The effect on the eastern half of the line is shown to be much less with a correspondingly smaller increase in traffic on Lakeshore East. Estimates for the Georgetown and Richmond Hill services remain unchanged.

Neglecting the effect of the downtown terminal location for the CP lines, Figure 15 indicates that all lines with the exception of Richmond Hill maintain their relative positions in terms of patronage throughout the 10-year period for which traffic estimates have been made. Of the four lines being considered in detail, the Georgetown service remains on top with respect to patronage estimates while the Richmond Hill line slips from second place in 1972 to third and fourth places in 1977 and 1982 respectively. This is largely due to the effect of opening the Yonge Street subway extension.

As subway construction proceeds in Metropolitan Toronto, the effect of competition between subways and commuter rail services must of course, be taken into account. In the case of the Richmond Hill line, the Yonge Street subway extension, expected to be completed to Finch Avenue by 1974, basically serves the same corridor. With the opening of this extension however, severe capacity problems are expected on the southerly sections of the subway line and alternative means of public transit via the commuter rail route would therefore provide some needed relief. Construction of a new subway or alternative form of rapid transit in the Spadina corridor might also have some effect on commuter rail patronage on the Richmond Hill line, and possibly on the Georgetown line as well. These effects are most likely to be felt at commuter rail stations fairly close to the central city. In fact, estimates for the

York Mills station (on the Richmond Hill line), and the Weston station (on the Georgetown line), show substantial losses with the introduction of the new subway lines. However, these are both relatively low volume stations to begin with and their viability would have to be considered in much more detail prior to the inauguration of new services on these lines.

In the case of the Streetsville line, some competition from existing subway service could be expected. There would be a significant travel time advantage from Islington station to downtown (because of the high frequency of stops and because of the need to transfer to either the Yonge or Spadina subways), in favour of the commuter rail service and this would decrease desirable patronage on the Bloor Street subway. However, since this subway is now in operation, the patronage estimates for the Streetsville line already allow for such competitive effects.

Provision of new commuter rail services would, of course, have some impact on automobile traffic. For example, in the case of the Richmond Hill and Malvern routes, a large proportion of the estimated patronage would be diverted from automobiles. This would result in some relief on downtown oriented expressways and arterial roads that are already highly congested during peak periods. From a planning point of view, this would be a highly desirable objective, although it must be realized that such relief would be relatively small in terms of the total volume of vehicular traffic now entering the central city during the peak period.

In addition to these general comments on the demand results, there are specific comments that apply to

the individual lines under consideration. Some of these are treated in Chapter 6 where they can be related to the cost information developed in the next chapter.

Chapter 5

COST ANALYSIS

Introduction

The cost of providing commuter rail services on existing railway facilities depends upon the physical characteristics of those facilities, the degree to which they are already used by other traffic, and the performance characteristics of the proposed new services. All other things being equal, higher speed and higher frequency will result in higher costs (although there may be some cost reductions through improved utilization of rolling stock). In the extreme, single track lines with lightweight rail and no signals will require heavy capital investment in plant whereas multiple track signalized lines may be able to accommodate limited commuter services with relatively little capital investment.

Estimating the costs of providing a particular level of service therefore, requires an understanding of the existing and planned operations of the railways. As a result, the railways themselves were asked to carry out an evaluation of their own lines and to estimate the plant improvements that would be required to accommodate new commuter rail services, according to certain specified performance characteristics. Specifically, for the lines identified in Chapter 3, each railway was requested:

- to assess the feasibility of running commuter trains on the specified routes;

- to determine what additions and/or modifications would be required to the existing rail facilities in order to operate a commuter service;

- to prepare cost estimates for these plant improvements;

- to develop estimates of the costs of operating the commuter service at the service levels specified.

Details of the railways' evaluations are contained in special reports produced for this study. This chapter attempts to assess and interpret these reports in terms of capital and operating cost summaries and related commentary for each line.

It must be emphasized that the cost summaries presented here should not be construed as representing formal proposals by the railways. However, the summaries do indicate the relative levels of investment required which can be used as a basis for negotiations on possible new commuter services for any of the rail lines studied. The cost estimates relate to a particular set of specifications concerning train length, frequency of trains, station locations and equipment type. If these specifications are changed significantly, the cost estimates obviously would also change.

Integration of Freight and Commuter Services

From a railway operating point of view, the problem of accommodating commuter services on existing rail lines is

one of establishing standards of performance for both freight and commuter trains and then determining a set of facilities and a mode of operation that would allow these standards to be achieved.

Theoretically, it is possible to operate a large number of train movements during any given 24 hour period on the routes considered. However, as traffic volume expands, traffic interference and associated train delay also increase. As utilization of physical plant is increased, the level of operational efficiency and the standard of performance will decrease. Delays to freight traffic become more serious with the introduction of commuter operations because commuter trains are closely scheduled and cannot be delayed to accommodate other moves. To compound this difficulty, commuter traffic is highly peaked and in Toronto, the time of these peaks corresponds closely with peaks in the movement of freight.

There are a number of characteristics of freight traffic that must be considered in any attempt to integrate freight and commuter operations. First, freight movements are integrated and closely interrelated with the national railway network. Second, in a highly competitive market, freight movements are designed to meet customer requirements and often must operate within certain time limits. This is particularly true in the case of containers which constitute an ever increasing proportion of general freight traffic. Third, although the daily pattern of train movements is generally repetitive, flexibility to accommodate a wide range of patterns must be maintained.

The plant improvements proposed by the railways to accommodate commuter rail services involve no significant change in the nature of existing freight operations. However, even with the proposed modifications and additions to plant, the railways expect to lose some flexibility and to incur some restrictions and delay in their freight operations. To some extent these plant changes will compensate for such restrictions by improving other aspects of freight operation.

For example, the solutions proposed by the railways provide for the utilization of "joint sections" which would be comprised of new sections of track and signals plus existing plant. One such case might be a section of line which is increased from two to three tracks with appropriate changes in the signal system. At times, it may be necessary for a commuter train to use one of the existing tracks normally used by freight traffic. This would restrict freight operations. At other times, freight operations would benefit from the additional track provided to accommodate commuter service. In this case, the plant modification would be charged to the commuter service. The operating costs of these joint facilities would be allocated on a wheelage basis which proportions operating costs such as maintenance-of-way, on the basis of the relative number of car-miles (or some other measure agreeable to both sponsor and railway) for each type of traffic.

Due to the concentrated nature of commuter rail patronage, levels of service were specified for evaluation. A "limited" service of two or three peak period trains, inbound to central Toronto in the morning and outbound in the evening, five days a week, would accommodate the major demand

for commuter rail service. These trains would be "fleeted" to minimize "meets" from opposing train movements. This enables the dispatcher to slot the commuter trains into existing railroad traffic, thereby minimizing additions and modifications to trackage and signals.

A higher level of service would be provided by a "full" service, specified as a peak period service of 5 to 6 trains with 20 minute headways five days a week, plus off-peak service of hourly trains in both directions 365 days a year. This is similar to the existing GO Transit Lakeshore service which runs about 18 hours a day. In the case of the full service, the cycling of equipment results in a large number of train meets particularly during peak periods. Under these circumstances, major investments in plant improvements must be made to reduce delays to both freight and commuter traffic. The additional capacity of a full service must be assessed in conjunction with the patterns of demand as well as with the substantial difference between the two levels of service in terms of capital investment and operating costs.

For purposes of designing plant improvements for a limited service, it was assumed that this level of service would be the initial step in the provision of a full service. It must be noted that although cost estimates have been provided for these two extremes in service (limited and full), it is not possible to interpolate directly between these limits. Different service specifications may have different implications for plant improvements, and there is no reason to believe that capital costs vary linearly between the two extremes in service.

For a specified service level, in terms of train frequency, a range of operating costs was determined corresponding to different train lengths (hence capacity). The cost summaries presented in this chapter are for 10-coach consists only[1]. Costs were also obtained for three basic types of equipment namely, double-deck coaches as used by CP Rail in Montreal, self-propelled Rail Diesel Cars (RDC) as previously manufactured by the Budd Co. of Philadelphia, and GO Transit type equipment (Hawker Siddeley coaches and self propelled cars). Analysis of the relative operating costs showed that the double-deck and GO Transit equipment resulted in the lowest costs[2]. Since these were comparable, only costs based on the use of GO Transit equipment are included in the chapter.

In addition to train consist and equipment type, other performance features of the existing GO Transit service were specified. For peak periods, push-pull trains powered by a 3000 HP locomotive with an auxiliary power unit were specified. Coaches were assumed to have 94 seats and to be equipped with remote control doors. Off-peak service is maintained with 2 coach self-propelled consists also accommodating 94 seats each. An average speed of 35 mph was specified and headways were established as 20 minutes or 30 minutes for peak periods depending on the level of service. Off-peak headways for full service were set at 60 minutes. Ticket collection was specified as "at station" as in the case of GO Transit, which requires ticket booths and personnel at each station. Crew size was assumed to be four man crews for push-pull consists and three man crews for self-propelled consists[3].

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1. Details are contained in the special railway reports.
2. The relevant details were provided in the CP report.
3. Refer to the following section for relevant assumptions regarding crew size.

Explanation of Cost Estimates

In their evaluation of each line, the railways segregated cost estimates into capital and operating costs. For each service, capital costs in 1972 dollars were presented as investment in plant and equipment. Annual operating costs were divided generally into direct operating costs and overhead costs. Under each category, however, each railway devised different cost breakdowns. For example, the CN estimates show a single item for overhead charges as 'Railway Surcharge' while the CP estimates show overheads as 'Depreciation, CPR Operating Fee, and Return on Investment'. Certain items, such as the cost of parking lots, were not evaluated by the railways. Estimates for such items were prepared by MTC, TTC or the study team.

In the following sections, the railways' evaluations are presented in capsule form by employing a series of cost tables (Tables 5.1 to 5.15)[1], and three schematic diagrams, (Figures 17, 18, 19)[2] which show main line track and signal additions or modifications required for the services summarized in the tables. The tables are grouped separately according to CN or CP lines. The figures indicate both CN and CP lines together. Table 5.1 presents a description of the CP services followed by Tables 5.2 to 5.8 which present capital, annual operating and unit annual operating cost estimates for two levels of service and variations thereof. Similarly, the CN tables are grouped together with Tables 5.9 and 5.14 outlining descriptions of the services, and

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1. Appended to this chapter, pages 137 to 151.
2. Pages 134, 135, 136.

Tables 5.10 to 5.13 and 5.15 presenting cost summaries. It may be noted that each service is designated by a code such as CP-B1 (CP route B, 1 denotes limited service) and CN-A2 (CN route A, 2 denotes full service).

In interpreting the cost tables, the following points should be noted:

1. For design purposes the railways assumed that a limited service would precede expansion to a full service. However, in the cost summaries presented here, the estimates for the full service are presented as absolute costs (i.e. not incremental to costs for a limited service).

2. No evaluation was made of how any one route could be integrated with another. Consequently, cost estimates for each service as outlined in the tables must be regarded as those costs which would occur if that service were the only one implemented. In this connection, estimates for the Streetsville to Malvern line were produced under the assumption that either the route via North Toronto or the route via Union were utilized, not both concurrently. Furthermore, no integration of services between Georgetown and Richmond Hill was investigated. If at some time, two or more services were integrated,[1] there would probably be significant cost savings especially in equipment requirements (because efficient cycling of trains improves equipment utilization), and associated operating costs.

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1. Integration of CN and CP services, such as Georgetown to Malvern via Union Station would raise special issues involving the operating unions.

3. Cost estimates shown for variations of limited services were derived by the study team based on estimates supplied by the railways for the appropriate basic limited service. Thus, estimates for CP-A1-1 were derived from CP-A1, CP-B1-1 and CP-C1 from CP-B1, CN-B3, B4, and B5 from CN-B1. In the case of the CP services, certain qualifications regarding capital costs were suggested by the railway in order that these limited service variations could be derived. For the CN services, the railway provided additional capital cost estimates for plant additions and modifications. These factors are described in detail under appropriate sections in the remainder of this chapter.

4. It was not possible to obtain cost estimates for the facility changes required for the Toronto Terminals Railway area in view of the proposed Metro Centre development. At the time of this study, there were many unknown factors about Metro Centre concerning design and cost-sharing arrangements which would have placed severe short-comings on any estimates that the Railways may have produced in this regard. A more detailed explanation of this is given later in this chapter. In the tables, a cost item is indicated for the Toronto Terminals Railway (TTR) as unknown for those services which use Union Station.

5. Most items included in the tables were assessed by the railways. Where items were estimated by another agency, the source is indicated. In the case of commuter rail-subway interchange facilities evaluated by the TTC, real estate values have not been included since these facilities would be located largely on railway property. The rental for this property would be included in overhead fees, etc., and in any event should be a negotiable item. The costs for these interchanges are largely independent of the service level.

   Estimates for parking lots were based on information supplied by MTC with respect to property appraisals and availability. In the derivation of costs shown in the tables, it was assumed that sufficient land would be purchased initially in 1972 dollars to satisfy the 1982 full service demand regardless of the service level under consideration.

6. Rolling stock prices were based on the most recent estimates available from GO Transit with respect to their equipment. The following costs include federal sales tax. Provincial sales tax is not applicable on railroad rolling stock.

Locomotive (3000 HP with auxiliary power unit)	$475,000
Self-Propelled Car (94 seats)	$450,000
Coach (94 seats)	$220,000
Control Car (i.e. coach with control cab for push-pull operation)	$300,000

7. The rules for assigning crews to short turn-around commuter runs are detailed in the collective agreements between the respective railway and the Unions. These agreements dictate crew size, length of working day and wage rates. In all agreements, a crew member is guaranteed a full day's wage based on minimum hours per day (or month) or minimum daily mileage travelled, even if his work for the day constitutes less than the minimum. One provision in the agreements provides that a worker may book rest after 11 hours on duty. In the case of the limited services, this means that one crew would be required for each morning train, while a different crew would be required for each afternoon train.

   Most current agreements require a crew size of 5 for locomotive hauled consists. In the case of the GO Transit operations, crew size has recently been reduced to 4 men and it has been assumed that similar crew sizes would be required for any new services. Negotiations with the unions would be required in the case of each service in order to achieve this concession.

The following sections describe the cost evaluation of each service on the various routes. CP lines are grouped together in Part I, CN lines in Part II. Each part begins with a brief definition of capital and operating cost items used by each railway and presented in the tables. For each specific line, a brief description of existing facilities is given followed by an outline of each service considered for that line.

Part I - CP Lines

Description of Cost Items

A description of the services studied on CP lines is presented in Table 5.1. Capital costs are shown in Table 5.2 and operating costs in Table 5.3 for two train limited services CP-A1 and CP-B1 and for full services CP-A2 and CP-B2. Table 5.4 contains unit annual operating costs derived from Table 5.3. Variations of limited services are shown as CP-A1-1, CP-B1-1 and CP-C1 in Tables 5.5, 5.6 and 5.7. A summary of the cost information for these various services is shown in Table 5.8. The following definitions describe the meaning of cost items indicated in the tables:

1. Capital Costs

   (a) Plant Facilities

   Track and Structures - additions or modifications to the joint section[1] of railway plant including main line track, sidings, switches, grading, overpasses and underpasses for rail/rail crossings, bridges, retaining walls.

   Stations - construction of 1000' platforms, fencing, lighting, ticket booths, shelters, pedestrian underpasses; track, grading and signals peculiar to certain stations.

   Signals - additional costs incurred by changing from Automatic Block Signals (A.B.S.) to Centralized Traffic Control (C.T.C.) within the joint section.

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1. The joint section would extend from Malvern Station to Streetsville Station. It would include: right-of-way property and grading, main line track directly on the commuter route, main track bridges and other structures, signal system associated with above track.

Leaside Yard - maintenance facilities including shop building and ancillary items, storage yard for commuter equipment, replacement of CP Rail Leaside freight storage facilities at Agincourt Yard.

Agincourt (Toronto) Yard - additions or modifications to track, grading, bridges, signals, telecommunication pole line, required within the Yard as a result of accommodating track space for commuter services.

TTC Interchanges - cost estimates provided by the Toronto Transit Commission for interchanges at commuter rail-subway interfaces. Estimates for real estate are not included.

Radio Communication - antenna tower and radio equipment to provide communication between the CP train dispatcher and commuter trains.

CP Rail Benefits - a negative cost which represents those facilities built for the commuter service which CP Rail would expect to construct by 1980 to accommodate CP freight traffic with or without commuter services.

Other Costs - a rough estimate provided by CP to cover items excluded from detailed evaluation such as land for additional right-of-way (land for parking lots included separately), alterations to underground facilities such as sewers and communication lines, alterations to above ground facilities such as power lines and extra grading costs such as landscaping and rock excavation.

Parking Lots - estimates based on information supplied by MTC for station access, grading, surfacing and real estate.

Toronto Terminals Railway - no estimate available.

(b) Equipment

Estimates for GO Transit type equipment including spares for certain services. Details are given with the description of each service.

2. Operating Costs (expressed on an annual basis)

(a) Exclusive to Commuter Rail (includes costs directly and exclusively allocated to the commuter operation)

Equipment Maintenance - cleaning interior and exterior of rolling stock and performing turn-around inspections; repair and maintenance of rolling stock including wages, fringe benefits, supervision and administration, and cost of material; maintenance of shop and Leaside Yard storage tracks; coach refit.

Train Operation - crew wages including fringe benefits; fuel costs.

Ticket Collection - based on GO Transit ticket collection procedures which employ one or two men at each station plus several men at Union Station for ticket sales and collection; estimates include wages and fringe benefits for personnel.

CP Management Fee - salaries and head office facility costs for managerial services applicable to the commuter operation.

Leaside Land Rental - lease cost of land used at the Leaside Yard for maintenance shop and storage tracks.

Parking Lot Maintenance - cost for general cleaning and snow removal of parking lots.

Supervision - staff costs and overheads for administration of commuter operation including salaries, fringe benefits, office supply, equipment and maintenance, and expenses for damage and injuries.

(b) Joint Facilities

Operating costs of joint facilities are shared between commuter service and CP on a wheelage formula basis. Wheelage is the ratio of commuter train 'car-miles' (both revenue and deadhead), to the 'total car-miles' operated within the joint section.

Maintenance-of-way - maintenance costs for track, bridges and structures, signals and other fixed facilities including such work as snow removal, rail testing and chemical weed killer.

Operation Costs - operating costs of communication systems, clerical staff, dispatching.

Property Taxes - for real estate within the joint section.

Toronto Terminals Railway - operating costs for the TTR are allocated on a per car basis between CP Rail, CNR and commuter services.

(c) Overhead

Depreciation - an annual charge to the commuter service as its share of the replacement cost of a proportion of CP's present facilities, calculated as follows. The capital cost of new plant facilities (track, signals, structures) required for the implementation of commuter services and to be included in the joint section is subtracted from the present day evaluation of CP's existing plant facilities within the joint section that would remain after implementation of the commuter service. An average depreciation rate of 2.1% is applied to the difference to derive an annual depreciation charge which is shared on a car-mile basis. In essence, the reasoning behind this charge is that CP's share

in the capital evaluation of the joint section is larger than the commuter rail share, and therefore the commuter service should participate in the replacement cost of the extra amount attributable to CP.

CPR Operating Fee - an annual charge to the commuter service which is considered as a fee to CP for operating the service, the ownership of the right-of-way, the loss of operating flexibility, and compensation for the risk of committing future expansion capacity; computed as 5% of the operating cost items included in 2(a) and (b) above with the exclusion of parking lot maintenance.

Return on Investment (R.O.I.) - annual charge to the commuter service as its share of the interest charges on CP's investment in fixed facilities jointly used by the commuter service; a total R.O.I. of 16% before tax on CP's present depreciated investment in joint facilities was proportioned according to the wheelage formula.

Streetsville - Malvern via North Toronto

(Tables 5.2 to 5.8; services CP-A1, CP-A2, CP-A1-1)

As shown in Figure 16, existing facilities on this route consist of about 32 miles of two track main line involving three subdivisions - Belleville, North Toronto and Galt. Train movements on this route are governed by C.T.C. from Nielson Road to Dixie. This provides full control over both CP and CN moves at the West Toronto Diamond[1] grade crossings. West of Dixie, train movements are controlled by A.B.S. From a traffic standpoint this route is comprised of the most heavily used sections of track in the entire CP system.

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1. The West Toronto Diamond is a major bottleneck in the Toronto CN and CP rail system. It actually consists of three distinct crossings requiring a total of eight diamonds.

The major CP rail yards in the Toronto area are located adjacent to this route. The Toronto Yard for the classification of traffic is located east of the existing Agincourt Station, between McCowans Road and Markham Road, at the junction of the Belleville and Havelock subdivisions (see Figure 3). Smaller yards are located at Leaside, which is used primarily for the storage of equipment and for serving local industries, and at Obico which is used mainly for piggyback and container traffic.

Existing station facilities along this route were considered for commuter use. In cases where the locations of these stations were suitable for commuter use, appropriate modifications were proposed. Existing station sites are located at Agincourt (Sheppard at Brimley), Leaside (at Millwood), North Toronto (Yonge Street), Cooksville (underpass at Highway 5), and Streetsville (junction of Galt and Orangeville subdivisions).

Commuter station locations on this route were outlined in Chapter 3 as shown in Figure 10. The same locations were used for both limited and full service evaluations. Equipment storage and maintenance facilities for all commuter services were assumed to be located at the existing Leaside Yard.

The following schedule was adopted for both limited and full services:

Westward (minutes)	Station (miles to Summerhill)	Eastward (minutes)
00	Malvern (12.3)	Arr. 55
05	Agincourt (8.9)	50
10	Victoria Park (5.9)	45
13	Don Mills (4.2)	42
17	Leaside (2.4)	38

(continued)

(continued)

Westward (minutes)		Station (miles to Summerhill)		Eastward (minutes)
21	Arr.	Summerhill (0)	Dep.	34
24	Dep.		Arr.	31
27		Spadina (1.3)		28
36		Islington (7.9)		19
41		Dixie (11.9)		14
46		Cooksville (14.5)		09
50		Erindale (16.6)		05
55	Arr.	Streetsville (19.4)		00

Note: All times are departure times except where noted. All intermediate stops are assumed to be 0.5 minutes.

The following comments relate specifically to each service evaluated on this route.

1. Limited Service CP-A1

A lead time of 1 1/2 to 2 years would be required to implement this service, with the major constraint being the delivery time on equipment.

(a) Plant Additions and Modifications (Table 5.2)

In the evaluation of limited services, additions and modifications to existing plant were designed to overcome difficulties at specific bottleneck areas to ensure that the operation of each commuter train would be reliable. The assumption was made that the limited service would be a forerunner to a full service. Consequently, the facilities required for the limited service have been designed as components of the full service requirements.

Figure 17 indicates that no substantial additions would be required in terms of continuous main line tracks on this route. The A.B.S. signal system between Streetsville and Erindale would be altered to permit C.T.C. train control in this area. Other changes required are noted as follows:

- construction of short sections of third main track at Kennedy, North Toronto and Obico;
- a third main track at grade at West Toronto;
- modification and additions to trackage and signal systems to accommodate stations at Victoria Park, Spadina, and Islington;
- construction of 12 commuter station platforms;
- storage tracks and maintenance stop at Leaside, with the resulting need to revise the main track layout and to replace existing CP Rail yard trackage;
- circuit changes to grade crossing signal systems to accommodate higher train speeds.

(b) Equipment Requirements (Table 5.2)

Four sets of equipment would be required to provide the morning service of 30 minute headways and three sets would be required for the afternoon service of 60 minute headways. Trains would be stored at the Leaside Yard during off-peak times and overnight

and weekends. Total units required are shown below including standby equipment.

	Locos	Coaches	Control Cars
Service	4	36	4
Standby	1	0	4
Total	5	36	8

A standby requirement of 4 control cars (coaches with control cabs for push-pull capability) has been established in order that these units could be used either as spare coaches or as spare control cars.

(c) Operating Considerations (Tables 5.3 and 5.4)

The collective agreements between CP and the Unions indicate that a total of 7 crews per weekday would be required for this limited service.

For ticket collection, two men would be required at each station other than North Toronto for each peak period. At North Toronto, three men would be required.

2. Full Service CP-A2

A lead time of about three years would be required to implement this service.

(a) Plant Additions and Modifications (Table 5.2)

This service was designed with the objective of overcoming overall congestion along the entire route and of ensuring that the operation of each commuter train would be reliable. The service

characteristics indicate that, in already busy freight traffic areas, there would be 43 meets between two revenue trains and approximately 20 meets between revenue trains and deadhead equipment moves. On each of these occasions, commuter trains would require the use of two main tracks. As indicated in Figure 18, substantial facility changes would be necessary to accommodate an additional continuous third track along the majority of the route.

The following additions to and/or modification of present facilities would be required:

- A continuous third main track between Kennedy and Thorncliffe Road - a distance of 18.6 miles;
- a third main track between the Etobicoke River to Highway No.5 - 2.35 miles;
- a third main track at Erindale - 2.5 miles;
- construction and realignment of trackage from Kennedy to the yard entrance at McCowans, to release a track to carry commuter trains around yard congestion;
- a depressed track to separate commuter trains from other traffic at West Toronto (noted as Grade Separation 3 in Figure 18);
- an elevated track to carry commuter trains over the congested area at Obico (noted as Grade Separation 4 in Figure 18);
- construction of 12 commuter station platforms;
- reconstruction and extension of the signal system to full double direction C.T.C. over the entire route;

- storage tracks and maintenance shop at Leaside, with the resulting need to revise the main track layout, and to replace existing CP Rail yard trackage.

The provision of these facilities would require major construction at some locations, while at others, upgrading of existing track would be sufficient. In particular, the provision of a third main track would necessitate the reconstruction of the following major facilities:

- Little Don River bridge (900 ft.)
- Don River Viaduct (810 ft.)
- Don Roadway bridge (386 ft.)
- Humber River bridge (471 ft.)

(b) Equipment Requirements (Table 5.2)

Seven push-pull train sets would be required to operate the specified 20 minute peak period service. For the hourly service during off-peak hours and weekends, three self-propelled (SP) train sets would be required. Total units required are shown below including standby equipment:

	Locos	SP	Coaches	Control Cars
Service	7	6	63	7
Standby	1	2	0	0
Total	8	8	63	7

It should be noted that no standby coaches have been included for the push-pull consists. It was assumed that equipment would be designed to enable a locomotive to trail SP units, in order that the SP equipment could be used as standby units during peak periods.

(c) Operating Considerations (Tables 5.3 and 5.4)

The agreements between CP and the unions would permit the service to operate with 14 crews on weekdays and 6 crews on weekends.

Ticket collection would require two men for each of two shifts at stations with one extra man for each peak period during weekdays. Twice this number would be required for the North Toronto station.

3. Limited Service Variation CP-A1-1

In the cost analysis for this three train service, two options were considered:

(i) to perform a detailed analysis similar to that required for CP-A1 in order to derive an entirely new set of estimates for plant, equipment, and operating costs;

(ii) to assume the same estimates for plant changes as for CP-A1 but to increase equipment requirements as required for the three train service.

Option (i) would be more exact but due to time and budgetary constraints option (ii) was chosen with certain qualifying assumptions.

If option (i) had been pursued, it is quite possible that the design would have indicated that with some minor schedule adjustments, the 4 consists required for CP-A1 could be cycled in order to achieve the 3 train CP-A1-1 service. Since the cycling of equipment would create additional commuter train meets, however, plant costs would be required in addition to those derived from CP-A1 to avoid congestion at 'meet' locations. In order to determine an equivalent cost for these plant additions without performing a detailed design, CP analysts suggested that the plant requirements for CP-A1 could be considered adequate if 2 train sets were utilized in addition to the 4 required for CP-A1. In other words, without cycling equipment and therefore increasing the number of train meets, the plant estimates for CP-A1 should be satisfactory for CP-A1-1. To complement this assumption, CP analysts suggested that the cost of plant plus equipment for CP-A1-1 thus derived should be considered as a "total" cost within which trade-offs could be considered between equipment and plant. If a CP-A1-1 service were seriously considered for implementation, the service specifications may actually dictate that a detailed analysis would be necessary for the following three options:

(i) equipment purchases as for CP-A1, 4 train sets;
(ii) five train sets;
(iii) six train sets

with corresponding degrees of plant investment. Thus the "total" cost for plant and equipment presented in Table 5.5 could be varied between equipment purchases and plant improvements.

It should be noted, however, that if an option to improve plant and minimize equipment purchases were chosen, the difference between the "total" capital costs of CP-A1-1 versus CP-A1 might be less than $6 million shown in Table 5.5. Furthermore, since operating costs are largely dependent on the number of trains in service, operating costs could be less than those presented here for CP-A1-1. In summary, then, the assumptions used in deriving costs for this service produce conservative estimates.[1]

(a) Plant Additions and Modifications (Table 5.5)

As explained above, the plant requirements for this service were assumed to be the same as for CP-A1. The only difference between the plant costs in Table 5.5 and those for CP-A1 in Table 5.2 relate to the grading and surfacing requirements for parking lots. Since CP-A1-1 would provide greater peak period capacity, parking lot sizes were increased accordingly.

(b) Equipment Requirements (Table 5.5)

In view of the considerations noted above, a total of six train sets would be required to operate the three train service with 30 minute headways from both Malvern and Streetsville. Total

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1. Similar assumptions are used for the derivation of "conservative estimates" for CP-B1-1 and CP-B1, as described in the following sections.

Units required are shown below including standby equipment:

	Locos	Coaches	Control Cars
Service	6	54	6
Standby	1	0	6
	7	54	12

As in the case of CP-A1, it was assumed that the spare control cars would also be used as spare coaches.

(c) Operating Considerations (Tables 5.6, 5.7)

The collective agreements between CP and the unions indicate that a total of 11 crews per weekday would be required for this service. Manpower requirements for ticket collection would be the same as for CP-A1.

Streetsville - Malvern via Union

(Tables 5.2 to 5.8, services CP-B1, CP-B2, CP-B1-1)

As shown in Figure 16, this route is comprised of the same sections of track as for the route via North Toronto except between West Toronto and Leaside. The route consists

of 20.3 miles of double main track from Streetsville to Union (Galt subdivision), 3.4 miles of single track from Union to Leaside, and 12 miles of double main track from Leaside to Malvern (Belleville subdivision). Train movements on this route are supervised by A.B.S. from Streetsville to Dixie, C.T.C. from Dixie to West Toronto, A.B.S. from West Toronto to the T.T.R., C.T.C. from the T.T.R. to Neilson Road. From a traffic standpoint, freight movements between Leaside and West Toronto are substantially less via Union than via North Toronto. This route is exposed to the same freight yard areas as the North Toronto route. In addition, the T.T.R. presents another restrictive area through which commuter trains must move.

In comparison to the North Toronto route, this route has the same number of existing station sites. Commuter station locations on this route were outlined in Chapter 3 as shown in Figure 10. Instead of Spadina and Summerhill for the North Toronto route, Union and Bloor were included. The Bloor station provides an interchange with the Bloor subway at the TTC Dundas West station. As in the case of the North Toronto route, station locations chosen for this route were used for both limited and full service evaluations. Furthermore, equipment storage and maintenance facilities for all commuter services were located at the Leaside yard.

The following schedule was assumed for both limited and full services:

Westward (minutes)		Station (miles to Union)		Eastward (minutes)
00		Malvern (15.4)	Arr.	62
05		Agincourt (12.0)		57
10		Victoria Park (9.0)		52
13		Don Mills (7.3)		49
17		Leaside (5.5)		45
25	Arr.	Union Station (0)	Dep.	36
28	Dep.		Arr.	33
35		Bloor (3.9)		26
42		Islington (8.8)		19
47		Dixie (12.8)		13
52		Cooksville (15.4)		09
57		Erindale (17.5)		05
62	Arr.	Streetsville (20.3)		00

Note: All times are departure times except where noted. All intermediate stops are assumed to be 0.5 minutes.

The following comments relate specifically to each service evaluated on this route.

1. Limited Service CP-B1

A lead time of 1 1/2 to 2 years would be required to implement this service, with the major constraint being the delivery time on equipment.

(a) Plant Additions and Modifications (Table 5.2)

For this service, the same plant changes would be required as for limited service (CP-A1) via North Toronto but with the following two exceptions relating to the section between West Toronto and Leaside:

- construction of short sections of third main track at North Toronto would not be required;
- modification and additions to track and signal systems to accommodate a station at Spadina would not be required.

No significant plant changes will be required between West Toronto and Leaside through Union.

(b) Equipment Requirements (Table 5.2)

The same equipment purchases as for the limited service via North Toronto (CP-A1) would be required for this service.

(c) Operating Considerations (Tables 5.3 and 5.4)

As for the North Toronto route, 7 crews per weekday would be required for this service. Ticket collection requirements would also be similar to CP-A1 whereby two men would be required at each station other than Union for each peak period, and three men would be required at Union.

With respect to Table 5.3, it should be noted that the significant difference between the total annual operating costs of a service via North Toronto and a service via Union, is mainly due to the inclusion of an operating charge for the TTR in the case of services via Union.

2. Full Service CP-B2

A lead time of about three years would be required to implement this service.

(a) Plant Additions and Modifications (Table 5.2)

As indicated in Figure 18, substantial facility changes would be necessary to accommodate an additional third main line along the majority of the route. In fact, the same plant additions described under full service CP-A2 would be required with the following exceptions:

- A third track between Leaside and West Toronto (a distance of 6 miles), and the depressed track at West Toronto would not be required;
- instead, a third main track would be necessary from Parkdale to West Toronto, a distance of 2.3 miles, and also from Thorncliffe Road to Etobicoke River, 1.7 miles;
- in addition, a third track at grade level through the West Toronto area would be required.

(b) Equipment Requirements (Table 5.2)

This service would have the same equipment requirements as the full service via North Toronto (CP-A2).

(c) Operating Considerations (Tables 5.3 and 5.4)

Requirements for crews and station personnel would be the same as for the full service via North Toronto (CP-A2).

3. Limited Service Variation CP-B1-1

For the cost analysis of this three train service, the same assumptions and qualifications with respect to the derivation of plant and equipment costs for CP-A1-1 (via North Toronto) apply. As a consequence, the difference between plant costs as presented in Table 5.5 for this service and plant costs presented in Table 5.2 for CP-B1, relates to the increase in parking lot costs resulting from the increase in peak period capacity. Equipment requirements for six train sets plus spares are the same as for CP-A1-1. Crew and station personnel requirements for this service would also be the same as for CP-A1-1.

The major difference in operating costs between CP-B1-1 and CP-A1-1 relates to the inclusion of an operating charge for the TTR in the case of the CP-B1-1 service via Union.

Malvern - Union

(Tables 5.5 to 5.8; Service CP-C1)

This three train service is the eastern half of the CP-B1-1 service. It is treated separately to distinguish it from the "through" routes via Union and via North Toronto (routes B and A respectively). Similar assumptions, criteria, and specifications as for the CP-B1-1 service were used, except that only the section of the route between Union and Malvern was considered.

(a) Plant Additions and Modifications (Table 5.5)

As suggested by CP, cost estimates for track, structures and signals applicable to the section of track between Union and Malvern were derived from the relevant costs presented for the CP-B1 service (Streetsville through to Malvern) by proportioning the costs from CP-B1 according to mileage. The route mileage of the CP-B services is 35.7 miles, while the Union to Malvern section measures 15.4 miles. This ratio was also used to derive the "Other Cost" category. For the remaining plant cost categories under CP-C1, either the entire cost from CP-B1 was used as in the case of the Leaside Yard, or discrete components of the cost under CP-B1 were used as in the case of stations and parking lots.

In addition, specific modifications to plant between Union and Malvern can be abstracted from the list of items presented under the limited service CP-A1 as follows:

- construction of a short section of third main track at Kennedy;

- modification and additions to trackage and signal system to accommodate the Victoria Park Station;
- construction of 5 commuter station platforms;
- storage tracks and maintenance shop at Leaside, with the resulting need to revise the main track layout and to replace existing CP Rail yard trackage;
- circuit changes to grade crossing signal systems to accommodate higher train speeds.

(b) Equipment Requirements (Table 5.5)

Three sets of equipment plus spares would be required to operate the service in each peak period. Total units required are shown below including standby equipment.

	Locos	Coaches	Control Cars
Service	3	27	3
Standby	1	0	3
Total	4	27	6

No spare coaches have been included since spare control cars can operate as spare coaches.

(c) Operating Considerations (Tables 5.6 and 5.7)

A total of 6 crews per weekday would be required. For ticket collection, two men would be required at each station other than Union for each peak period. At Union, three men would be required.

Part II - CN Lines

Description of Cost Items

A description of the services analysed on CN lines is presented in Table 5.9 for the basic limited and full services and in Table 5.14 for limited service variations on the Richmond Hill line. The costs provided by CN for the basic limited and full services on the Georgetown (CN-A1, CN-A2) and Richmond Hill routes (CN-B1, CN-B2) are shown in Tables 5.10 and 5.11. Table 5.12 contains unit annual operating costs derived from Table 5.11. A summary of the basic cost information provided for limited services CN-A1 and CN-B1 and for full services CN-A2 and CN-B2 is presented in Table 5.13. A comparison of capital and operating costs for all services considered on the Richmond Hill line (CN-B1, B2, B3, B4, B5) is summarized in Table 5.15.

The following definitions describe the meaning of cost items indicated in the table:

1. Capital Costs

   (a) Plant Facilities

   Track and Structures - additions or modifications to the joint section of railway plant including main line track, sidings, switches, grading, overpasses for rail/rail crossings, bridges, retaining walls. Includes overnight storage facilities at Richmond Hill or Georgetown.

   Stations - construction of 850' platforms, fencing, lighting, ticket booths, shelters, pedestrian underpasses; track, grading and signals related to certain stations.

Signals - additional costs incurred by changing from train orders to an A.B.S. or C.T.C. system or from an A.B.S. to a C.T.C. system.

Real Estate - estimates for strips of land to expand the existing right-of-way in order to incorporate additional plant facilities. This does not include land for parking lots, subway interchange facilities, or land for equipment storage and maintenance facilities.

Willowbrook Expansion - estimates to expand the existing Willowbrook shop and storage facility now used for GO Transit equipment, in order to accommodate equipment from new services. Real estate costs are excluded. (Willowbrook is located between Long Branch and Mimico stations on the GO Transit line).

Land for Willowbrook Expansion - availability of property dictates that only moderate growth can be accommodated at Willowbrook. Expansion of this facility will require further study and may not be the best long term answer for equipment maintenance if additional commuter services are planned and if the construction of Metro Centre requires that CN's Spadina maintenance facility be relocated to the Willowbrook area. Because of these factors, it may be necessary to construct a new maintenance facility at another location. The additional cost of acquiring land at Willowbrook or at some other location was not identified by CN and is therefore indicated to be unknown in the appropriate column for this cost category. Note that this item does not apply to the Georgetown limited service.

Toronto Terminals Railway - not applicable to the Georgetown limited service. Estimates not available for other services.

Bloor Subway Interchange - estimates provided by the TTC for this facility are applicable only to services on the Georgetown line where an interface with the Bloor Subway is possible at the Dundas West subway station. Estimates for real estate requirements are not included.

CN Telecommunications - modifications required to telecommunication facilities to incorporate the signal system required for full services.

Parking Lots - estimates based on information supplied by MTC for station access, grading, surfacing and real estate for parking lots.

(b) Equipment

Estimates for GO Transit type equipment including spares for certain services. Costs based on 10 coach peak period consists. Details are given with the description of each service.

2. Operating Costs (expressed on an annual basis)

Equipment Maintenance - daily and periodic cleaning of coaches and locomotives; running repairs, mileage inspections, and periodic maintenance of units; includes overheads applicable to Willowbrook operation due to shop expansion and increased work force. Back-shopping of locomotives is not included.

Maintenance of way - maintenance costs of new track and signals, additional wear and tear on existing trackage, plus land taxes on new real estate.

Station Expenses - includes one night watchman at overnight storage facilities at Georgetown and Richmond Hill, the net change in CN/CP sharing of the TTR expenses if additional wheelage is charged to CN, and station personnel for ticket collection.

Train operation - crew wages excluding fringe benefits; fuel costs.

Railway Surcharge - CN designated a mark-up of 35% on direct operating costs (equipment maintenance + maintenance of way + station expenses + train operation), as compensation for additional fixed expenses that would be incurred by CN in operating a commuter service. Expenses would include return on investment, depreciation and maintenance expenses for track, Spadina shops, and CN stations that would be incorporated into a commuter service, plus overhead expenses as a result of TTR use, and CN management, administration and general overhead expenses.

Station and Parking Lot Maintenance - estimate based on information provided by GO Transit for general cleaning, maintenance, and snow removal applicable to stations and parking lots.

Coach Refit - estimate provided by study team of equivalent annual cost of refitting coaches which would probably be necessary every 10 years at a one-time unit cost of $40,000.

Supervision - estimate provided by study team for supervision and administration of commuter service by sponsor.

Georgetown/Brampton - Union

(Tables 5.9 to 5.13; services CN-A1, CN-A2)

As shown in Figure 16, existing facilities on this 29.4 mile route consist of various single and double track sections involving the CN Halton and Weston subdivisions. Train movements are now governed by A.B.S. from the T.T.R. to Weston, by train orders from Weston to Halwest (junction of Halton, Weston, and York subdivisions) and by C.T.C. from Halwest to Georgetown. From a traffic standpoint, the majority of CN's freight traffic from or to the west uses the Halton Subdivision as a connecting link to the CN freight classification yard at Maple.

As with CP lines, existing station facilities along this route were considered for commuter use. Where locations were suitable, additions or modifications were proposed. Existing station sites are located at Georgetown, Brampton, Malton, Weston, West Toronto and Parkdale. Commuter station locations on this route were outlined in Chapter 3 and shown in Figure 10.

Analysis of the limited service CN-A1 was based on running trains from Georgetown to Union with the following stations: Georgetown, Brampton (east of Kennedy Road), Bramalea (south of Steeles), Malton (existing station site), Weston (existing station site), Bloor (at Dundas West subway station) and Union. For the full service CN-A2, an additional station site was selected at Rexdale (just west of Kipling Ave.), the Malton station was moved just south of Derry Road, and the other stations outlined above for the limited service CN-A1 remained in the same location. Off-peak trains of the full service would only operate between Brampton and Union, a distance of 21.3 miles. The Georgetown station would only be used for peak period trains.

Normal equipment servicing and maintenance would be performed at Willowbrook, except for locomotive periodic maintenance at the Spadina shops and turnaround cleaning at Georgetown.

The following sections relate specifically to each service evaluated on this route.

1. Limited Service CN-A1

The Province of Ontario has already announced that a three train service will be introduced between Georgetown

and Union in late 1973. With the introduction of this service, CN has assumed that approval would be obtained from the Canadian Transport Commission to discontinue trains 986 and 987 between Guelph and Toronto. Although the new service to Georgetown will initially consist of shorter trains than were assumed for this study, the basic information presented here formed the basis of design for the new service.

Equipment would be cycled to travel inbound to Toronto in the morning, layover at the Willowbrook depot during the off-peak daytime hours, and travel outbound to Georgetown at night. The equipment would be deadheaded to Willowbrook on weekends for storage.

The description of this service is summarized in Table 5.9. The following schedule was assumed:

Inbound (minutes)	Station (miles to Union)			Outbound (minutes)
00	Georgetown	(29.4)	Arr.	55
10	Brampton	(21.3)		45
16	Bramalea	(17.5)		38
22	Malton	(15.3)		32
32	Weston	(8.6)		21
40	Bloor	(4.0)		12
52 Arr.	Union	(0)		00

Note: All times are departure times except where noted.

(a) Plant Additions and Modifications (Table 5.10)

CN also assumed that a limited service would precede a full service, and therefore facilities required for a limited service have been designed as components of a full service.

Figure 17 indicates that no substantial additions would be required in terms of continuous main line tracks on this route. The train order signal system between Halwest and Weston would be converted to an A.B.S. system. Other changes required are noted as follows:

- facilities at Georgetown for storage and servicing of equipment overnight;
- service tracks between Halwest and Rexdale to remove industrial activity from the main line;
- construction of new stations at Bramalea and Bloor and improvements to four existing stations; modification and additions to track and signals to accommodate all stations;
- additional facilities at Willowbrook to accommodate storage and maintenance of three train sets.

It should be noted that this service can be accommodated with the present TTR facilities. Some rescheduling of the Lakeshore GO Transit service will be required in order to integrate the services at Union.

(b) Equipment Requirements (Table 5.10)

Three sets of equipment would be required as follows: 3 locomotives, 27 coaches, 3 control cars. No standby equipment was included since it was assumed that new equipment would be pooled with the existing GO Transit fleet for which standby equipment will be necessary in any case when a programme of backshopping commences.

(c) Operating Considerations (Tables 5.11 and 5.12)

The agreements between CN and the unions dictate that a total of 6 crews per weekday would be required to operate this three train limited service. For at station ticket collection, two men would be required at each station other than Union. Existing Union Station ticket collection staff is expected to be able to handle the additional load from the forthcoming Georgetown limited service and therefore costs for Union personnel were not included.

2. Full Service CN-A2

The description for this service is shown in Table 5.9. A lead time of at least three years would be required to make the necessary plant changes and to acquire suitable equipment. Since a limited three train service from Georgetown would be in operation prior to introduction

of a full service, it has been assumed these three trains would continue to serve Georgetown during peak periods. The additional trains required for the full service have been assumed to operate only as far as Brampton.

The following schedule was assumed:

Inbound (minutes)	Stations (miles to Union)	Outbound (minutes)
00	Georgetown (29.4) Arr.	48
10	Brampton (20.1)	38
14	Bramalea (17.5)	34
19	Malton (14.7)	29
26	Rexdale(11.0)	21
31	Weston (7.9)	15
38	Bloor (4.0)	08
46 Arr.	Union (0.0)	00

Note: All times are departure times except where noted. Only three peak period trains would stop at Georgetown.

(a) Plant Additions and Modifications (Table 5.10)

As indicated in Figure 18, substantial facility changes would be required in order to double or triple track certain sections of the line, and also to convert the entire route to C.T.C. double direction train control. In addition to those changes required for the limited service CN-A1, the following additions or modifications would be required:

- a railway grade separation at the West Toronto grade crossing, noted as Grade

Separation 2 in Figure 18, plus a by-pass track at grade for heavy freight trains and connecting movements to West Toronto Yard;

- double tracking of the present single track section of the route between Halwest and West Toronto, together with relocation of ancillary tracks and facilities;
- a third main line on the Halton subdivision between Halwest and a point just east of Brampton, a distance of 3 miles, and one mile of double tracking just east of Brampton;
- extension of service tracks on the Halton subdivision to remove industrial activity from the main tracks between Halwest and Brampton;
- upgrading of the signal system between Halwest and the TTR to full double direction C.T.C., and incorporation of additional track on the Halton subdivision in the existing C.T.C. system;
- new facilities at the Malton area to accommodate a station just south of Derry Road; construction of a new station at Rexdale;
- a new equipment depot or expansion of Willowbrook;
- plant revisions to the TTR to provide additional capacity, although no cost is shown for this item.

(b) Equipment Requirements (Table 5.10)

In addition to the equipment required for the limited service (CN-A1), self-propelled equipment would be required to operate during off-peak hours and weekends. A four coach SP consist

would operate before and after the three push-pull consists designated for the limited service in order to augment peak period capacity. Off-peak and weekend operations would require two consists of two coach SP units. Total units required for the operation of this service are shown below including standby equipment:

	Locos	SP	Coaches	Control Cars
Service	3	8	27	3
Standby	1	2	2	0
Total	4	10	29	3

(c) Operating Considerations (Tables 5.11, 5.12)

A total of 9 crews would be required to operate this service on a weekday. Ticket collection personnel would be required as follows: two men at Georgetown, four men at Brampton, Bramalea, Malton, Rexdale, Weston, Bloor and twelve additional men at Union.

Richmond Hill - Union

(Tables 5.9 to 5.15; services CN-B1, CN-B2, CN-B3, CN-B4, CN-B5)

As shown in Figure 16, this section of the Bala subdivision consists of 21 miles of single track under C.T.C. train control. The only existing station on this route is located in the centre of Richmond Hill.

Commuter station locations on this route were outlined in Chapter 3 and shown in Figure 10. Stations at Richmond Hill (south end of town), Thornlea, Finch, and York Mills were specified for analysis of both limited and full services.

Equipment storage, servicing, and maintenance were assumed to be performed at the Willowbrook depot, although constraints on land availability at this location would probably force this facility to be moved to another location. Periodic maintenance of locomotives would be performed at Spadina and turnaround cleaning at Richmond Hill.

A basic two train limited service (CN-B1) and a full service (CN-B2) were evaluated in detail by CN. Limited service variations CN-B3, CN-B4, and CN-B5 were estimated by the study team in collaboration with CN using the basic information provided for CN-B1 and CN-B2. The following comments relate specifically to each service evaluated on this route.

1. Limited Service CN-B1

The description of this two train service is shown in Table 5.9. A lead time of 12 to 18 months would be required, the major constraint probably being the delivery time on equipment.

Equipment would be cycled to travel to Toronto in the morning, layover in the Willowbrook depot during the day, travel outbound to Richmond Hill in the afternoon peak period, and layover there at night. The equipment would be deadheaded to Willowbrook on weekends for storage.

The following schedule was assumed for this service:

Inbound (minutes)		Station (miles to Union)		Outbound (minutes)
00		Richmond Hill (20.8)	Arr.	50
07		Thornlea (17.0)		42
14		Finch (14.1)		35
22		York Mills (11.0)		27
48	Arr.	Union (0)		00

Note: All times are departure times except where noted.

(a) Plant Additions and Modifications (Table 5.10)

Consistent with the analysis for services on the Georgetown line, facilities required for this limited service have been designed as components of a full service.

Figure 17 indicates that no substantial additions would be required in terms of main line track or signal system. Plant changes are noted as follows:

- a facility at Richmond Hill for storage and servicing of equipment overnight;
- station facilities at Richmond Hill, Thornlea, Finch and York Mills;
- replacement of spring switches for sidings at York Mills and Rosedale by power switches for remote control operation;

- additional facilities at Willowbrook depot to provide capacity for storage and maintenance of equipment (subject to possible relocation of Willowbrook as mentioned previously; note that land cost for Willowbrook is indicated as being unknown);

- additions to the TTR may be required but a cost for this is also indicated as unknown.

(b) Equipment Requirements (Table 5.10)

Two sets of equipment would be required as follows: 2 locomotives, 18 coaches, 2 control cars. No standby equipment was included for the same reasons given under the limited service CN-A1.

(c) Operating Considerations (Tables 5.11 and 5.12)

A total of 4 crews per weekday would be required to operate this service. Ticket collection would require two men at each suburban station for both peak periods and two additional men at Union Station.

2. Full Service CN-B2

The description of this service is outlined in Table 5.9. Lead time of at least three years would be required for plant revisions and acquisition of equipment.

The following schedule was assumed:

Inbound (minutes)		Station (miles to Union)	Outbound (minutes)
00		Richmond Hill (20.8) Arr.	37
06		Thornlea (17.0)	29
10		Finch (14.1)	24
16		York Mills (11.0)	19
34	Arr.	Union (0)	00

Note: All times are departure times except where noted.

(a) Plant Additions and Modifications (Table 5.10)

As indicated in Figure 18, another main line track would be required for the entire length of the route. Train control would be augmented to full double direction C.T.C. In addition to those changes required for the limited service CN-B1, the following changes would be required for this service:

- additional main line track to provide a double track route from Richmond Hill to the the TTR;

- a single track railway grade separation between the Bala subdivision and York subdivision (noted as Grade Separation 1 in Figure 18) leaving the existing diamond crossing for freight operations;

- relocation of tracks and switches in the vicinity of the Leaside branch track;

- a short section of service track at Thornlea to remove industrial traffic from the main tracks and to overcome grade differences caused by the grade separation;
- upgrading of the signal system on the entire route to full double direction C.T.C.;
- additional storage tracks for trains at Richmond Hill;
- a new equipment depot or expansion of Willowbrook;
- additional main line capacity equivalent to double track between Dundas Street and the Kingston subdivision in the vicinity of the TTR limits;
- plant revisions to provide additional capacity on the TTR, which have not been costed.

(b) Equipment Requirements (Table 5.10)

In addition to the equipment required for the limited service (CN-B1), another push-pull consist would be required for peak periods, and self-propelled equipment would be required to operate during off-peak hours and weekends. Allocation of trainsets would be similar to that outlined under the full service to Georgetown. Total units required for the operation of this service are shown below including standby equipment:

	Locos	SP	Coaches	Control Cars
Service	3	8	27	3
Standby	1	2	1	1
Total	4	10	28	4

(c) Operating Considerations (Tables 5.11, 5.12)

A total of 10 crews would be required to operate this service on a weekday. Ticket collection personnel would be required as follows: four men at each suburban station and no additional men at Union.

It was assumed that before a full service were contemplated in the Richmond Hill line, a full service would have been implemented on the Georgetown line whereby ticket collection personnel requirements would be sufficient to handle another full service.

3. Limited Service Variations CN-B3, CN-B4, CN-B5

In order to investigate the effect of increasing peak period capacity by adding trains, three additional limited services were specified as outlined in Table 5.14.

Operating costs for these services were derived by the study team from the basic data provided by CN for the basic CN-B1 and CN-B2 services. Capital costs for plant changes were provided by CN in a separate analysis of these limited service variations. Equipment requirements are indicated for all three services in Table 5.14.

Rather than provide detailed cost information for these services, a summary of costs was constructed as shown in Table 5.15. Services CN-B1 and CN-B2 are included for comparative purposes.

The mode of operation for these services would be similar to that described under CN-B1. The following sections provide brief descriptions of the plant changes required under each service.

(i) Variation CN-B3:

With three trains, it becomes necessary to allow for opposing CN moves on the section between Richmond Hill and the York subdivision, requiring a double track section in this area. South of the York subdivision, it would be necessary to allow for fleeting plus some opposing moves between commuter trains. This would require the relocation and construction of certain sidings and storage tracks with corresponding replacement and relocation of power switches. Changes to the signal system would also be required.

Furthermore, storage capacity would be required at Richmond Hill and at Willowbrook. Provisions for stations would be the same as outlined under CN-B1.

(ii) Variation CN-B4:

Although opposing movements by commuter trains would not be required, it would be necessary to allow for opposing CN movements. Double track sections and a railway grade separation at the York subdivision would also be required.

Specifically, the section between Steeles Avenue and Richmond Hill would require: a second main line, two sets of crossovers, a single track crossing over the York subdivision, and a new service track in the vicinity of John Street. Between Steeles and the TTR, plant changes would be as follows: a second main line 3.3 miles in length which incorporates the existing Oriole siding; replacement of storage track at Oriole; a second main line, about 5 miles in length, connecting to the TTR and incorporating the existing Rosedale siding. In addition, storage facilities would be required at Richmond Hill and at Willowbrook. Provisions for stations would be the same as outlined under CN-B1.

(iii) Variation CN-B5

This service is basically the same as the CN-B4 service with the exception of train size. Requirements would be the same as for CN-B4 but additional capacity would be required at Richmond Hill and Willowbrook.

Toronto Terminals Railway and Metro Centre

Throughout this chapter, reference has been made to the TTR and the associated Metro Centre development. The existing TTR corridor extends from Bathurst Street in the west through Union Station to the Don River in the east (approximate limits are indicated on Figures 16 to 18). From the west, trains enter the TTR via the CN Oakville, CN Weston and CP Galt subdivisions which converge at a confined section of track at Bathurst Street. Capacity restriction at this point is compounded by deadhead moves caused by commuter trains departing or returning to the Willowbrook depot. In addition to the Bathurst Street bottleneck, there are constraints on track and platform utilization within Union Station itself. Due to these restrictions, additional commuter services from the west, over and above the existing GO Transit service and the proposed Georgetown limited service, could not be adequately accommodated without major plant improvements involving a rail/rail grade separation at Bathurst.

With respect to services from the east, either a limited Richmond Hill service or a limited Malvern service could probably be accommodated without plant changes. However, further services from the east would require significant changes to plant in the form of a rail/rail grade separation in order to avoid conflicting movements in the Don area.

Other factors affect the design of a new downtown railway plant corridor. Major street changes such as the extension of Front Street West to the Gardiner Expressway and the design of the western section of Metro Centre must be well defined for

the adjacent rail corridor to conform.

The Metro Centre plan for the redevelopment of the downtown railway lands calls for relocating the TTR rail corridor on a southerly alignment paralleling the Gardiner Expressway. If limited services on the Georgetown and Richmond Hill (or Malvern) routes were added to existing services, the new corridor would require capacity similar to that provided by the existing TTR corridor with minimal improvements. Full commuter service on new routes and/or increased frequency on the Lakeshore would present the same problems for the Metro Centre rail corridor as for the existing TTR corridor. Grade separations would be required at roughly the same cost in either case.

The new Metro Centre corridor can be designed to accommodate a high level of commuter service. However, once rail lines are grade separated at either end of the development and sufficient room is allocated for additional platforms, adequate capacity within the corridor would be secured for a variety of additional services. Should the opportunity to provide adequate capacity be by-passed, future expansion of commuter services will not be possible once the rail corridor is confined by the new development.

A later stage of the Metro Centre development will require removing the CN Spadina equipment maintenance facilities. The existing vacant space adjacent to the Willowbrook depot has been reserved for relocating these facilities. As a result, the expansion of the present Willowbrook depot for storage and maintenance of commuter equipment must be considered.

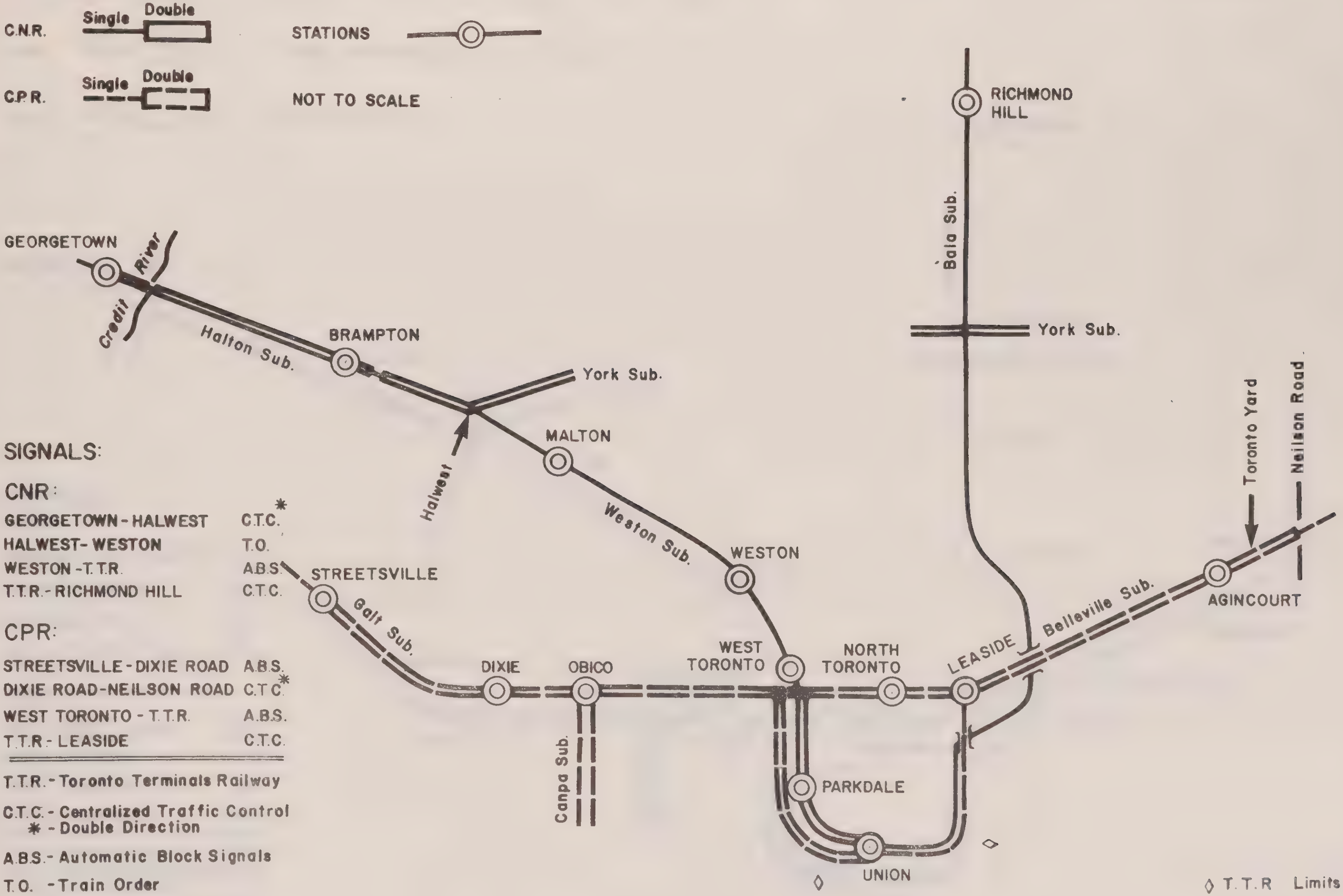
Even without this relocation, there are two problems which affect the use of the Willowbrook depot for commuter equipment. First, Willowbrook is off line for routes other than the Lakeshore and therefore deadhead moves will account for considerable non-revenue mileage. Second, these moves will add to capacity problems on the main lines between Willowbrook and downtown. This is particularly true in the early afternoon when there is heavy traffic consisting of extra commuter equipment for the afternoon peak period as well as regular intercity passenger trains.

One solution to the problem of equipment maintenance facilities created by the Metro Centre development involves constructing a new depot at another location. This will have to be considered in detail if decisions are made to introduce full services on new commuter routes. Possibilities of integrating equipment maintenance facilities for both CN and CP should also be explored in view of the possible economies of scale.

Due to the complexity of the problems relating to the TTR and the related Metro Centre development, it was not possible to consider even a preliminary design of increasing capacity through the TTR for expanded commuter services. Therefore, cost estimates for the associated items presented in the cost tables were indicated to be unknown.

TORONTO COMMUTER RAIL STUDY FIG. 16

EXISTING (1972) MAIN LINE TRACK AND SIGNAL CONFIGURATION FOR LINES STUDIED



SIGNALS:

CNR:

GEORGETOWN - HALWEST	C.T.C.*
HALWEST - WESTON	T.O.
WESTON - T.T.R.	A.B.S.
T.T.R. - RICHMOND HILL	C.T.C.

CPR:

STREETSVILLE - DIXIE ROAD	A.B.S.
DIXIE ROAD - NEILSON ROAD	C.T.C.*
WEST TORONTO - T.T.R.	A.B.S.
T.T.R. - LEASIDE	C.T.C.

T.T.R. - Toronto Terminals Railway

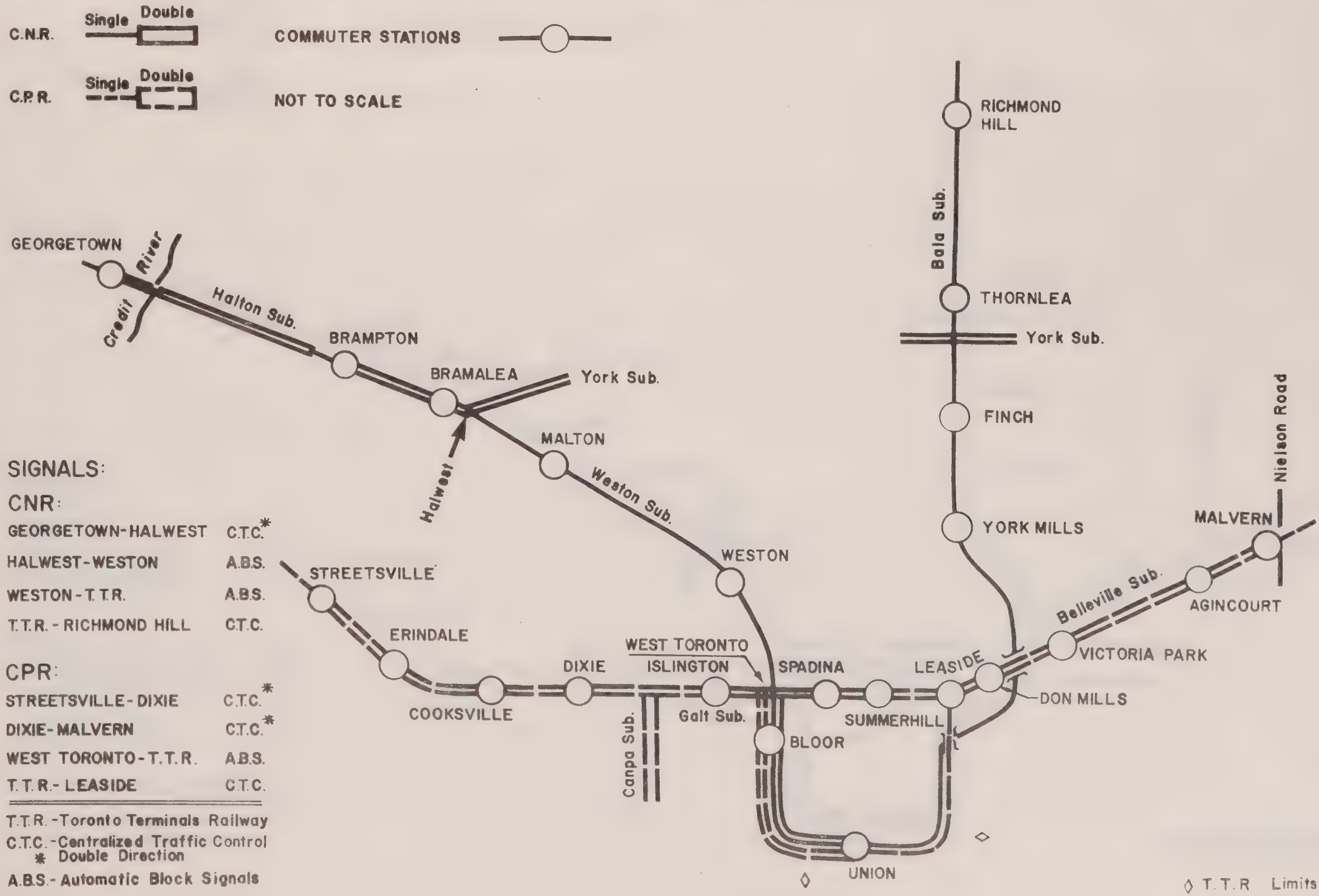
C.T.C. - Centralized Traffic Control
* - Double Direction

A.B.S. - Automatic Block Signals

T.O. - Train Order

TORONTO COMMUTER RAIL STUDY FIG. 17

LIMITED SERVICES-PROPOSED MAIN LINE TRACK AND SIGNAL CONFIGURATION FOR LINES STUDIED



TORONTO COMMUTER RAIL STUDY FIG. 18

FULL SERVICES - PROPOSED MAIN LINE TRACK AND SIGNAL CONFIGURATION FOR LINES STUDIED

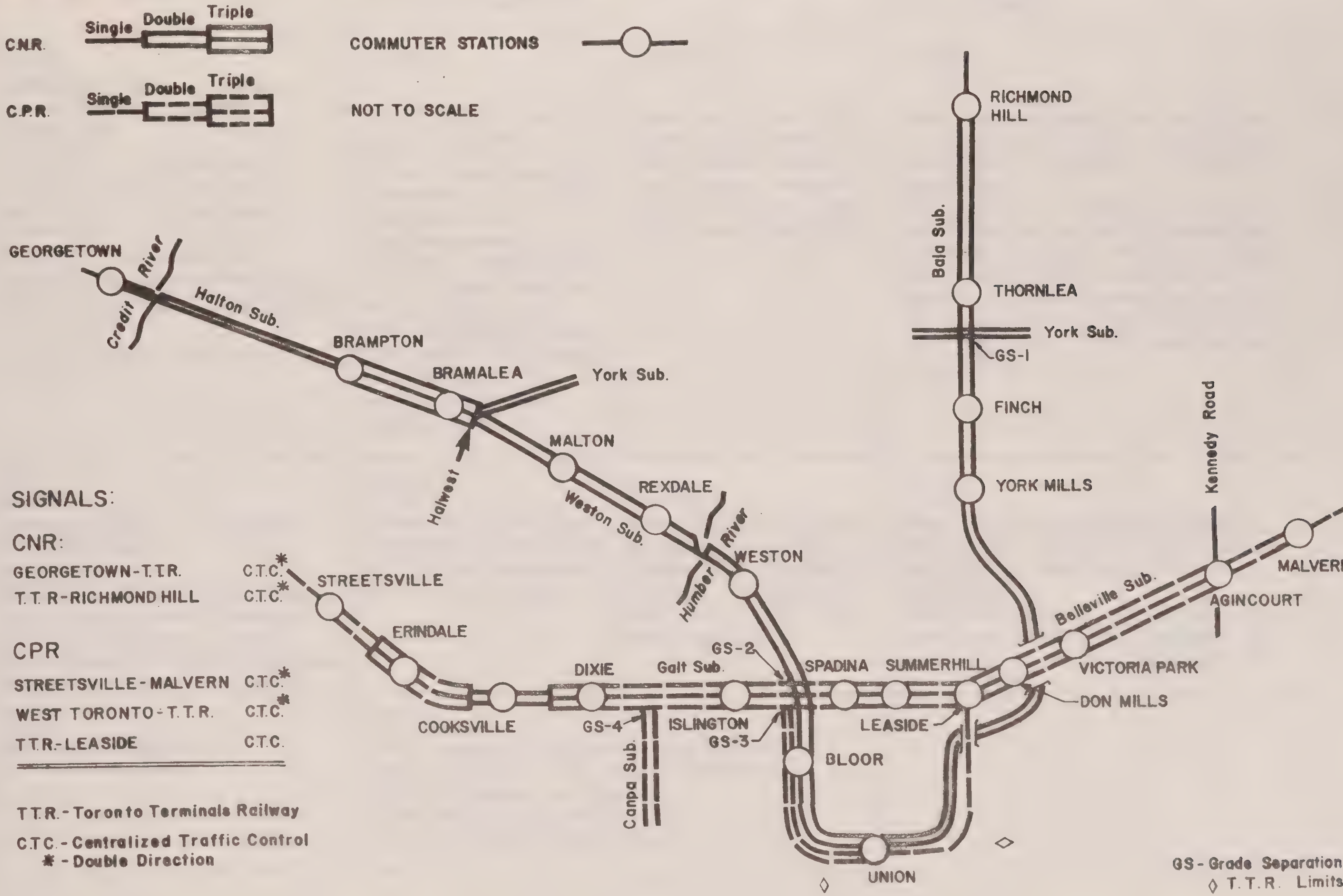


Table 5.1
DESCRIPTION OF SERVICES SUMMARIZED IN TABLES 5.2 TO 5.8

	LIMITED SERVICE		FULL SERVICE
CP-A STREETSVILLE - MALVERN VIA NORTH TORONTO Stations: Malvern, Agincourt Victoria Pk., Don Mills Leaside, N. Toronto Spadina, Islington Dixie, Cooksville Erindale, Streetsville Streetsville - N.Toronto: 19.4 mi. N. Toronto - Malvern: 12.3 mi.	CP-A1 2-10 coach push-pull trains: A.M. Peak Period- Streetsville and Malvern to N. Toronto - 30 min. headways. P.M. Peak Period- N. Toronto to Streetsville and Malvern - 60 min. headways. 250 operating days/year.	CP-A1-1 Same as CP-A1 but with 3-10 coach push-pull trains at 30 min. headways for A.M. and P.M. peak periods.	CP-A2 Peak period service similar to CP-A1 but with 4-10 coach push-pull trains at 20 min. headways. Off-peak and weekend service maintained with Self-Propelled 2 coach trains, 0630 to 0030, departing and arriving at North Toronto every hour to and from both Streetsville and Malvern. 365 operating days/year.
CP-B STREETSVILLE - MALVERN VIA UNION Stations: Same as CP-A but replace N. Toronto and Spadina with Union and Bloor. Streetsville-Union: 20.3mi. Union-Malvern: 15.4 mi.	CP-B1 Same as CP-A1 but trains in and out of Union instead of N. Toronto.	CP-B1-1 Same as CP-B1 but with 3-10 coach push-pull trains at 30 min. headways for A.M. and P.M. peak periods.	CP-B2 Peak Period Service similar to CP-B1 but with 4-10 coach push-pull trains at 20 min. headways. Off-peak and weekend service same as CP-A3 but trains in and out of Union instead of N. Toronto.
CP-C MALVERN - UNION	CP-C1 3-10 coach push-pull trains for peak period - 30 min. headways A.M. Malvern to Union P.M. Union to Malvern 250 Operating days/year		

Table 5.2

STREETSVILLE-MALVERN
CAPITAL COSTS in $1000 (1972)

	SERVICE LEVELS[2]			
	N. TORONTO ROUTE		UNION ROUTE	
	CP-A1	CP-A2	CP-B1	CP-B2
PLANT FACILITIES[1]				
Trackage and Structures	2,100	18,400	1,900	17,000
Stations[3]	3,397	3,497	2,837	2,937
Signals	2,600	6,800	2,400	6,800
Leaside Yard	2,100	2,600	2,100	2,600
Agincourt (Toronto) Yard	50	2,000	50	2,000
T.T.C. Interchanges[4] - Spadina	470	470	-	-
- Islington	770	770	770	770
- N.Toronto	0	0	-	-
- Dundas W.	-	-	150	150
Radio Communication	55	70	55	70
C.P. Rail Benefits[5]	-449	-449	-411	-411
Other Costs[6]	1,000	5,000	1,000	5,000
Parking Lots[7] - Land	1,060	1,060	1,365	1,365
- Other	650	1,485	870	1,980
Toronto Terminals Railway	-	-	?	?
TOTAL PLANT	13,803	41,703	13,086	40,261
EQUIPMENT[8]	12,695	23,360	12,695	23,360
TOTAL CAPITAL COSTS	26,498	65,063	25,781	63,621

1. Estimates supplied by CP except where noted.
2. For description of services see Table 5.1.
3. Estimates for lighting, booths, shelters, underpasses based on CN unit costs.
4. Estimates by T.T.C. for connections between station platform and subway entrances. North Toronto costs assumed to be absorbed by developer of Summerhill Square. Real estate costs not included.
5. Portion of plant (signals and tracks) that will have to be provided by CP Rail by 1980 to accommodate CP traffic.
6. CP Rail 'guestimate' for items not analysed in detail - real estate for additional right-of-way (not parking lots), relocation of above and underground facilities, noise abatement measures, extra grading costs.
7. Based on information (unit costs and patronage estimates) supplied by MTC.
8. See text for details of equipment requirements

Table 5.3

STREETSVILLE-MALVERN

ANNUAL OPERATING COSTS[1] in $1000 (1972)

	NORTH TORONTO ROUTE		UNION ROUTE	
	CP-A1[2]	CP-A2	CP-B1	CP-B2
Exclusive to Commuter Rail				
Equipment Maintenance	566	1,604	569	1,684
Train Operation - Crew[3]	361	722	361	722
- Fuel	17	90	17	95
Ticket Collection[4]	228	1,226	228	1,226
CP Management Fee	13	50	13	50
Leaside Land Rental	50	61	50	61
Parking Lot Maintenance[5]	96	110	96	110
Supervision[6]	190	356	190	356
Joint Facilities				
Maintenance-of-way	25	132	29	172
Operation Costs[7]	4	21	5	28
Property Taxes	10	35	9	35
T.T.R.	-	-	300	1,016
Overhead[8]				
Depreciation	30	60	30	60
CP Operating Fee	73	215	88	272
R.O.I[9]	84	305	107	425
TOTAL ANNUAL COST	1,747	4,987	2,092	6,312

1. Estimates supplied by CPR except where noted.
2. For description of services see Table 5.1.
3. See text for assumption re crew size.
4. Includes Union Station staff.
5. Based on information supplied by MTC.
6. Management costs for supervision of service (similar to GO Transit supervision).
7. For dispatchers, superintendent, clerical staff
8. See text for explanation of items.
9. Return on Investment.

Table 5.4

STREETSVILLE-MALVERN

UNIT ANNUAL OPERATING COSTS [1] in 1972 DOLLARS

	N. TORONTO ROUTE		UNION ROUTE	
	CP-A1	CP-A2	CP-B1	CP-B2
Equipment Maintenance				
Total \$/Train-Mile[2]	7.59	2.91	7.19	2.69
- Loco Portion (\$/Loco-mile)	1.85	1.45	1.74	1.31
- Coach Portion (\$/Coach-mile)	0.57	0.40	0.55	0.36
- S.P. Portion (\$/S.P.-mile)	-	0.56	-	0.53
Maintenance-of-way				
\$/Route-Mile	789.	4164.	812.	4818.
Train Operation				
\$/Train-Mile[2]	5.07	1.47	4.78	1.30
Operating Cost/Train Trip[3]-\$	867.	179.	1038.	224.
Operating Cost/Seat Trip[3]-\$	0.92	0.38	1.10	0.48
Operating Cost/Train-Mile[2]-\$	23.42	9.04	26.44	10.08
Operating Cost/Rev.Seat-Mi. -\$	0.06	0.024	0.06	0.027

1. For description of services see Table 5.1 .

2. Includes deadheading.

3. One-way trip: i.e. Malvern to Union, N. Toronto to Streetsville, etc.

Table 5.5

STREETSVILLE-MALVERN

LIMITED SERVICE VARIATIONS[1]

CAPITAL COSTS in $1000 (1972)

	VIA N. TORONTO CP-A1-1	VIA UNION CP-B1-1	MALVERN-UNION CP-C1
PLANT FACILITIES			
Trackage and Structures	2,100	1,900	817
Stations	3,397	2,837	1,334
Signals	2,600	2,400	1,032
Leaside Yard	2,100	2,100	2,100
Agincourt (Toronto) Yard	50	50	50
TTC Interchanges - Spadina	470	-	-
- Islington	770	770	-
- N. Toronto	-	-	-
- Dundas West	-	150	-
Radio Communications	65	65	50
C.P. Rail Benefits	-449	-411	-171
Other Costs	1,000	1,000	430
Parking Lots - Land	1,060	1,365	735
- Other	975	1,305	712
Toronto Terminals Railway	-	?	?
TOTAL PLANT	14,138	13,531	7,089
EQUIPMENT[2]	18,630	18,630	9,540
TOTAL CAPITAL COSTS	32,768	32,161	16,629

1. See Table 5.1 for description of services. Estimates derived by study team based on costs presented in Table 5.4. See text for explanation and interpretation of results.

2. See text for details of equipment requirements.

Table 5.6

STREETSVILLE-MALVERN

LIMITED SERVICE VARIATIONS -

ANNUAL OPERATING COSTS[1] in $1000 (1972)

	VIA N. TORONTO CP-A1-1	VIA UNION CP-B1-1	MALVERN-UNION CP-C1
Exclusive to Commuter Rail			
Equipment Maintenance	778	784	428
Train Operation - Crew	567	567	309
- Fuel	25	25	10
Ticket Collection	228	228	119
CP Management Fee	13	13	8
Leaside Land Rental	56	56	42
Parking Lot Maintenance	100	100	56
Supervision	190	190	179
Joint Facilities			
Maintenance-of-way	37	48	15
Operation Costs	6	8	6
Property Taxes	14	15	4
T.T.R.	-	440	227
Overhead			
Depreciation	30	30	15
CP Operating Fee	96	119	67
R.O.I.	124	177	53
TOTAL ANNUAL COST	2,264	2,800	1,538

1. See Table 5.1 for description of services. Estimates derived by study team based on costs presented in Table 5.3. See text for explanation and interpretation of results.

Table 5.7

STREETSVILLE-MALVERN

LIMITED SERVICE VARIATIONS

UNIT ANNUAL OPERATING COSTS[1] in 1972 DOLLARS

	VIA N. TORONTO CP-A1-1	VIA UNION CP-B1-1	MALVERN-UNION CP-C1
Equipment Maintenance			
Total $/Train-Mile[2]	6.95	6.66	9.22
- Loco Portion ($/Loco-mile)	1.55	1.47	2.57
- Coach Portion($/Coach-mile)	0.54	0.52	0.72
Maintenance-of-way			
$/Route-Mile	1167.	1345.	974.
Train Operation			
$/Train-Mile[2]	5.29	5.03	6.87
Operating Cost/Train Trip[3] - $	749.	933.	1017.
Operating Cost/Seat Trip[3] - $	0.80	0.99	1.08
Operating Cost/Train-Mile[2] - $	20.23	23.78	33.13
Operating Cost.Rev. Seat-Mile - $	0.05	0.06	0.07

1. For description of services see Table 5.1 .
2. Includes deadheading.
3. One-way trip: i.e. Malvern to Union, N. Toronto to Streetsville, etc.

Table 5.8

SUMMARY OF COSTS[1] - STREETSVILLE TO MALVERN
(all costs in 1972 dollars)

	NORTH TORONTO ROUTE			UNION ROUTE			MALVERN-UNION
	CP-A1	CP-A1-1	CP-A2	CP-B1	CP-B1-1	CP-B2	CP-C1
CAPITAL INVESTMENT ($1000)							
Fixed Facilities[2]	11,093	11,103	34,158	9,851	9,861	31,916	5,212
Equipment	12,695	18,630	23,360	12,695	18,630	23,360	9,540
Parking Lots - Land	1,060	1,060	1,060	1,365	1,365	1,365	735
- Other	650	975	1,485	870	1,305	1,980	712
Other Costs[3]	1,000	1,000	5,000	1,000	1,000	5,000	430
T.T.R.	-	-	-	?	?	?	?
TOTAL INVESTMENT ($1000)	26,498	32,768	65,063	25,781	32,161	63,621	16,629
ANNUAL OPERATING COSTS ($1000)							
Train Operating and Maint.	944	1,370	2,416	947	1,376	2,501	747
Maintenance-of-way	25	37	132	29	48	172	15
Ticket collection	228	228	1,226	228	228	1,226	119
Parking Lots	96	100	110	96	100	110	56
Supervision	190	190	356	190	190	356	179
Other[4]	264	339	747	602	858	1,947	422
TOTAL ANNUAL COST ($1000)	1,747	2,264	4,987	2,092	2,800	6,312	1,538
UNIT ANNUAL OPERATING COSTS							
Operating Cost/Seat Trip	$ 0.92	$ 0.80	$ 0.38	$ 1.10	$ 0.99	$ 0.48	$ 1.08
Operating Cost/Rev. Seat-Mi.	$ 0.06	$ 0.05	$0.024	$ 0.06	$ 0.06	$0.027	$ 0.07

1. For description of services see Table 5.1. For details of costs see Tables 5.2 to 5.7.
2. Includes costs for T.T.C. interchanges where applicable.
3. See Note 6, Table 5.2.
4. Items included (from Tables 5.3 and 5.6) CPR Management Fee, Leaside Land Rental, Operation Costs, T.T.R., Property Taxes, and Overhead.

Table 5.9

DESCRIPTION OF SERVICES SUMMARIZED IN TABLES 5.10 TO 5.13

	LIMITED SERVICE	FULL SERVICE
CN-A GEORGETOWN/BRAMPTON-UNION Stations: Georgetown Brampton Bramalea Malton Rexdale Weston Bloor (Dundas West) Union (Brampton - Union, 21.3 mi.) (Georgetown - Brampton, 8.1 mi.)	CN-A1 3-10 COACH PUSH-PULL TRAINS PER PEAK PERIOD: A.M. - Georgetown to Union (20 min. headways) P.M. - Union to Georgetown (20 min. headways) 252 Operating days/year (exc. weekends)	CN-A2 Peak Period Service as for LIMITED SERVICE (CN-A1). + SELF PROPELLED 2 - COACH TRAINS: Hourly Service, 0630 to 0030, both directions, Brampton - Union 365 Operating days/year (Gives 5 peak-period trains at 20 minute headways)
CN-B RICHMOND HILL-UNION Stations: Richmond Hill Thornlea Willowdale York Mills Toronto Union (Richmond Hill - Union, 21 mi.)	CN-B1 2-10 COACH PUSH-PULL TRAINS PER PEAK PERIOD: A.M. - Richmond Hill to Union (20 minute headway) P.M. - Union to Richmond Hill (60 minute headway) 252 Operating days/year (exc. weekends)	CN-B2 3-10 COACH PUSH-PULL TRAINS PER PEAK PERIOD: A.M. Richmond Hill - Union P.M. Union - Richmond Hill 252 Operating days/year + SELF PROPELLED 2 - COACH TRAINS: Hourly Service, 0630 to 0100, both directions, Richmond Hill - Union, 365 Operating days/year (Gives 5 peak period trains at 20 minute headways)

Table 5.10

GEORGETOWN/BRAMPTON-UNION AND RICHMOND HILL-UNION
CAPITAL COSTS in $1000 (1972)

	SERVICE LEVELS [2]			
	CN-A1	CN-A2	CN-B1	CN-B2
<u>PLANT FACILITIES</u>[1]				
Trackage and Structures	1,665	11,801	415	9,606
Stations	636	1,425	344	709
Signals	345	4,867	226	3,438
Real Estate[3]	313	496	-	1,300
Willowbrook Expansion	442	492	166	266
Land for Willowbrook Expansion[4]	-	?	?	?
Toronto Terminals Railway[4]	-	?	?	?
Bloor Subway Interchange[5]	1,590	1,590	-	-
CN Telecommunications	-	200	-	190
Parking Lots[6] - Land	475	587	65	150
- Other	750	1,350	365	900
TOTAL PLANT	6,216	22,808	1,581	16,559
EQUIPMENT [7]	8,265	13,680	5,510	13,760
TOTAL CAPITAL COSTS	14,481	36,488	7,091	30,319

1. Estimates supplied by CNR except where noted.
2. For description of services see Table 5.9.
3. For railway fixed facilities. Excludes land for Willowbrook expansion and land for parking lots.
4. For explanation of omission of costs under CN-A2, CN-B1, CN-B2, see text.
5. Real Estate costs (purchase or rental) not included. Estimate supplied by T.T.C.
6. Based on information (unit costs and patronage estimates) supplied by MTC.
7. No standby equipment included under CN-A1, CN-B1. Equipment unit costs supplied by GO Transit. For assumptions re standby equipment for CN-A2 and CN-B2 see text.
   Costs shown are for 10 coach peak period consists.

Table 5.11

GEORGETOWN/BRAMPTON-UNION AND RICHMOND HILL - UNION
ANNUAL OPERATING COSTS[1] in $1000 (1972)

	SERVICE LEVELS[2]			
	CN-A1	CN-A2	CN-B1	CN-B2
Equipment Maintenance	571	928	272	776
Maintenance-of-way	65	230	19	139
Station Expenses[3]	133	384	110	217
Train Operation - Crew	278	548	191	579
- Fuel	11	51	10	55
Railway Surcharge[4]	370	749	211	618
Station and Parking Lot Maint.[5]	48	56	32	40
Coach Refit[6]	90	126	60	126
Supervision[7]	125	245	72	204
TOTAL ANNUAL COSTS	1,691	3,317	977	2,754

1. Estimates supplied by CNR except where noted.
2. For description of services see Table 5.9. Costs developed for 10 coach consists in peak periods.
3. Includes Union Station staff.
4. Surcharge of 35% on direct operating costs includes contribution to overhead, rental of existing facilities, management fee, administration expenses, and use of T.T.R.
5. Estimate based on information supplied by GO Transit.
6. Study team estimate of $40,000 per coach every 10 years.
7. Study team estimate to cover supervisory costs applicable to sponsor of service.

Table 5.12

GEORGETOWN/BRAMPTON-UNION AND RICHMOND HILL-UNION
UNIT ANNUAL OPERATING COSTS in 1972 DOLLARS

	SERVICE LEVELS[1]			
	CN-A1	CN-A2	CN-B1	CN-B2
Equipment Maintenance				
Total $/Train Mile	8.81	2.54	8.24	2.13
- Loco. Portion ($/Loco-Mile)	2.80	2.58	2.12	2.67
- Coach Portion ($/Coach-Mile)	0.60	0.58	0.61	0.62
- S.P. Portion ($/S.P. Mile)	-	0.54	-	0.45
Maintenance-of-way[2]				
$/Route Mile	2,211	9,974	905.	6,612
Train Operation - $/Train Mile	4.46	1.63	6.09	1.73
Operating Cost/Rev. Train Trip[3]-$	1118.	216.	969.	171.
Operating Cost/Rev. Seat Trip[3] -$	1.19	0.72	1.03	0.58
Operating Cost/Train-Mile[4] -$	26.11	9.02	29.61	7.55
Operating Cost/Rev. Seat-Mile -$	0.04	0.03	0.05	0.03

1. For description of services see Table 5.9. Costs shown are for 10 coach peak-period consists.
2. Because the Self-Propelled Portion of the CN-A2 service operates only as far as Brampton, the value under CN-A2 represents costs for the Union to Brampton section only.
3. One way trip.
4. Includes deadheading.

Table 5.13

SUMMARY OF COSTS[1] - CN LINES
(all costs in 1972 dollars)

	Georgetown/ Brampton-Union		Richmond Hill - Union	
	CN-A1	CN-A2	CN-B1	CN-B2
CAPITAL INVESTMENT ($1000)				
Fixed Facilities - Plant	4,678	20,375	1,151	14,209
- Land	313	496	0	1,300
Equipment	8,265	13,680	5,510	13,760
Parking Lots - Land	475	587	65	150
- Other	750	1,350	365	900
Willowbrook Expansion	-	?	?	?
T.T.R.	-	?	?	?
TOTAL INVESTMENT ($1000)	14,481	36,488	7,091	30,319
ANNUAL OPERATING COSTS ($1000)				
Train Operating and Maint.[2]	950	1,653	533	1,536
Maintenance-of-way	65	230	19	139
Station Expenses	133	384	110	217
Railway Surcharge	370	749	211	618
Parking Lots	48	56	32	40
Supervision	125	245	72	204
TOTAL ANNUAL COST ($1000)	1,691	3,317	977	2,754
UNIT ANNUAL OPERATING COSTS				
Operating Cost/Seat Trip	$ 1.19	$ 0.72	$ 1.03	$ 0.58
Operating Cost/Rev. Seat-Mile	$ 0.04	$ 0.03	$ 0.05	$ 0.03

1. Refer to Tables 5.9 to 5.12 for details.

2. Includes coach refit.

Table 5.14

RICHMOND HILL - UNION

DESCRIPTION OF SERVICE LEVELS CN-B3, B4, B5

1. Stations: Richmond Hill, Thornlea, Finch, York Mills, Union.

2. No off-peak and weekend services. For A.M. peak, trains run inbound to Toronto; for P.M. peak, trains run outbound to Richmond Hill.

3. Consists:

CN-B3: 3-10 coach push-pull trains at 30 minute headways (i.e. 2820 one-way seats)

CN-B4: 3-10 coach push-pull trains and 2-4 unit self-propelled trains at 20 minute headways (i.e. 3572 one-way seats)

CN-B5: 5-10 coach push-pull trains at 20 minute headways (i.e. 4700 one-way seats)

4. Equipment requirements:

		CN-B3	CN-B4	CN-B5
Service:	Locos.	3	3	5
	Coaches	30	30	50
	S.P.'s	-	8	-
Standby:	Locos.	-	-	1
	Coaches	-	-	2
	S.P.'s	-	2	-

Table 5.15

RICHMOND HILL - UNION

COST COMPARISON OF VARIOUS LIMITED SERVICES
(all costs in 1972 dollars)

	SERVICE LEVELS[1]				
	CN-B1[2]	CN-B2[2]	CN-B3	CN-B4	CN-B5
CAPITAL INVESTMENT ($1000)					
Fixed Facilities	1,151	15,509	2,486	9,157	9,184
Rolling Stock	5,510	13,760	8,265	12,765	14,770
Parking Lots	430	1,050	657	860	880
Willowbrook Expansion	?	?	?	?	?
T.T.R.	?	?	?	?	?
TOTAL INVESTMENT ($1000)	7,091	30,319	11,408	22,782	24,834
ANNUAL OPERATING COSTS ($1000)					
Train Operating and Maint.[3]	533	1,536	938	1,335	1,511
Maintenance-of-way	19	139	30	44	48
Station Expenses	110	217	110	110	110
Railway Surcharge	211	618	346	479	530
Parking Lots	32	40	32	40	40
Supervision	72	204	116	160	179
TOTAL ANNUAL COSTS ($1000)	977	2,754	1,572	2,168	2,418
UNIT OPERATING COSTS					
Operating Cost/Seat Trip	$1.03	$0.58	$1.11	$1.20	$1.02
Operating Cost/Rev. Seat-Mile	$0.05	$0.03	$0.05	$0.06	$0.05

1. See Tables 5.9 and 5.14 for description of services.
2. See Tables 5.10 and 5.12 for details.
3. Includes coach refit.

Chapter 6

EVALUATION

Basis of Analysis

The preceding chapters have presented estimates of potential patronage and costs for the four lines in the basic network of railway facilities being analysed. In the strict sense of the term economic analysis, a traditional approach would require translation of these estimates into a stream of revenues and costs over the planning period. This stream would then be discounted into present value terms taking into account interest rates and appropriate salvage values so as to provide a comparison of the profitability of capital investment in the different facilities. This traditional approach has not been followed in the present study for a number of reasons.

First, the patronage estimates that have been prepared are not sensitive enough to reflect differences in the quality of service such as frequency, speed and the availability of feeder systems. In future years, such factors are likely to have more importance than fares in an increasingly affluent society. Moreover, the forecasting model used to prepare these patronage estimates has been calibrated on a fairly dated small sample and may have relevance only for a particular range of service quality. Aggressive marketing of new transit services may produce much stronger incentives for diversion from automobile than are presently recognized in any available forecasting models for the area. In fact, this has already been evidenced by the GO Transit experience

where energetic marketing and high quality service have led to actual patronage in excess of forecasts.

Second, the cost estimates have basically been prepared for two classes of service, namely, peak period service (limited), and full schedule service. In each case, certain assumptions have been made about the motive power and the number of coaches to be used. These have not been varied over the period of analysis to produce changes in operating and maintenance costs that would be consistent with increasing demand. In practice, of course, operating changes and equipment additions would be made in accordance with patronage changes and the actual cost experience would therefore be variable.

Third, the major objective of this analysis is to provide a basis for decision making. In this context, benefit-cost analysis or other forms of traditional economic analysis may not be particularly meaningful. That is not to suggest that decisions should be insensitive to the economic evaluation. However, a benefit-cost analysis which is confined to dealing only with direct costs and benefits would probably lead to conclusions that services were not justified on economic grounds. For a variety of other social and political reasons, however, they may be desirable. Decisions relating to potential new commuter rail services will probably be made on the basis of the cost effectiveness of these services in terms of costs and subsidies per passenger handled compared to other forms of transportation. The mix of capital and operating cost requirements will also be important from the point of view of risk, precedents that may be established, and the continuing commitments that inauguration of new service may present.

The approach which has been followed involves comparing the cost effectiveness of capital investments first, in alternative peak period services and second, in alternative full schedule services. What the cost data of the preceding chapter show with respect to capital improvement requirements is that *some peak period service is possible by rescheduling of normal freight traffic and "fleeting" of commuter trains so as to minimize the need for plant improvements. Increasing schedule frequency in a manner which extends the peak period and provides off-peak service infringes upon this capability to accommodate commuter service by scheduling adjustments alone. This results in the need for major plant improvement to accommodate cycling of commuter equipment and to reduce delays to freight traffic.*

For peak period service, the assumption has been made that train lengths would be adjusted so as to insure load factors of almost 100%. Based on this assumption, cost effectiveness for different lines can be compared in terms of cost per *seat* or per *seat mile* provided. For full schedule operation, this assumption cannot be made since off-peak load factors would be significantly lower. In this case, cost per *passenger* or per *passenger mile* becomes the more relevant (and the more difficult) comparison to make. In the following sections therefore, full service comparisons are sensitive to estimates of patronage; limited services are not.

Since the following sections provide cost comparisons in terms of both one time costs incurred for capital improvements and cost and revenues[1] which recur on an annual basis, some assumption about interest rates and facility lives are necessary. An interest rate of 8% has been used throughout

1. Based on 1972 GO Transit fares (single ticket rate of 70 cents minimum plus about 5 cents per mile after 12 miles).

and economic lives of 30 years and 20 years have been used for plant improvements and rolling stock respectively. These assumptions are fairly conservative since many of the plant improvements such as parking lots and right-of-way acquisition will have economic lives well in excess of 30 years.

Limited Service Alternatives

The cost data presented in Chapter 5 deal with a number of limited service options for the various CN and CP lines under consideration. These are summarized in Table 6.1. The data have been organized somewhat differently from those shown in the tables of Chapter 5 with respect to annual operating costs in order to distinguish between those costs which are directly attributable to the provision of service, and the various management, administrative and overhead fees which probably allow more latitude for negotiation.

As noted in Chapter 5, these cost estimates do not include any allowance for increasing capacity at Union Station in conjunction with the new Metro Centre development. Such improvements in terminal capacity benefit the entire system of commuter rail facilities, including the existing GO Transit services and the proposed Georgetown service. The associated costs should therefore not be allocated specifically to the services under consideration here.

Some limited service alternatives are, of course, mutually exclusive and for each line some "preferred" limited service must be selected for purposes of comparison with other lines in terms of cost effectiveness. Four such

Table 6.1

Summary of Costs and Revenues - Limited Service Alternatives
(all costs in 1972 dollars)

	CP-A1 via N. Toronto	CP-A1-1 via N. Toronto	CP-B1 via Union	CP-B1-1 via Union	CP-C1 Malvern -Union	CN-A1 G.Town -Union	CN-B1 R.Hill -Union	CN-B3 R.Hill -Union
Mileage	31.7	31.7	35.7	35.7	15.4	29.4	21.0	21.0
A.M. Peak Trains	4	6	4	6	3	3	2	3
Daily Seats	7,520	11,280	7,520	11,280	5,640	5,640	3,760	5,640
Capital Costs ($1000)								
Plant	13,800	14,140	13,080	13,530	7,090	6,220	1,580	3,140
Rolling Stock	12,700	18,630	12,700	18,630	9,540	8,260	5,510	8,260
Total	26,500	32,770	25,780	32,160	16,630	14,480	7,090	11,400
per mile	840	1,030	720	900	1,080	490	340	540
Operating Costs ($1000)								
Direct	1,300	1,740	1,300	1,750	940	1,200	690	1,110
Fees, Overhead, etc.	450	530	790	1,050	600	500	280	560
Total	1,750	2,270	2,090	2,800	1,540	1,700	980	1,570
Annual Costs ($1000)								
Operating	1,750	2,270	2,090	2,800	1,540	1,700	980	1,570
Revenue	1,230	1,830	1,300	1,950	960	1,170	730	1,100
Deficit	520	440	790	850	580	530	250	470
Capital	2,520	3,150	2,450	3,100	1,600	1,390	700	1,120
Total Subsidy	3,040	3,590	3,240	3,950	2,180	1,920	950	1,590
Unit Costs ($/seat)								
Operating	0.93	0.80	1.11	0.99	1.09	1.20	1.03	1.10
Revenue	0.65	0.65	0.69	0.69	0.68	0.82	0.77	0.77
Deficit	0.28	0.15	0.42	0.30	0.41	0.38	0.26	0.33
Capital	1.34	1.11	1.30	1.10	1.13	0.98	0.74	0.79
Total Subsidy	1.62	1.26	1.72	1.40	1.54	1.36	1.00	1.12

"preferred" services are highlighted in Table 6.1 (denoted by shading). Three of these offer a choice of three trains during each peak period. A two train peak period service between Richmond Hill and Union Station is also included since this alternative does provide the lowest total unit cost service of all, although obviously it provides less capacity as well.

Table 6.1 has been constructed assuming a 100% load factor. In other words, these costs represent a situation in which all passengers are seated and in which every seat is occupied at some point. Obviously, load factors may be less upon the introduction of a new service with a corresponding increase in costs, particularly with respect to unit capital costs. On the other hand, as traffic increases and some passengers are forced to stand, load factors will exceed 100%,producing a reduction in costs.

Full Service Alternatives

Cost data for the four full service alternatives are compared in Table 6.2. Similar comments concerning the manner of aggregating costs, the exclusion of Metro Centre costs, and assumptions about interest rates and economic lives apply as in the case of the limited service alternatives. However, unit costs are sensitive to estimates of actual patronage, as opposed to seats offered, because of the difference in load factor experienced between peak and off-peak riding. The figures shown therefore represent a typical year of operation (1977) and would vary for different time periods. Because of the lower patronage estimates on the CP route via North Toronto and correspondingly higher costs, subsequent references to costs on the Streetsville-Malvern route in the conclusions *refer to the CP route via Union Station.*

Table 6.2

Summary of Costs and Revenues - Full Service Alternatives 1977
(all costs in 1972 dollars)

	CP-A2 Via North Toronto	CP-B2 Via Union Station	CN-A2 Georgetown -Union	CN-B2 R.Hill-Union	GO-Transit (1972)
Mileage	31.7	35.7	29.4	21.0	42.3
Capital Costs ($1000)					
Plant	41,700	40,260	22,810	16,560	17,350
Rolling Stock	23,360	23,360	13,680	13,760	19,730
Total	65,060	63,620	36,490	30,320	37,080
per mile	2,050	1,780	1,240	1,440	882
Operating Costs ($1000)					
Direct	3,880	4,010	2,320	1,930	-
Fees, Overhead, etc.	1,100	2,300	990	820	-
Total	4,980	6,310	3,310	2,750	6,200[1]
Annual Costs ($1000)					
Operating	4,980	6,310	3,310	2,750	6,200
Revenue	1,660	2,900	2,390	1,630	3,900[2]
Deficit	3,320	3,410	920	1,120	2,300
Capital	6,080	5,930	3,420	2,870	3,430
Total Subsidy	9,400	9,340	4,340	3,990	5,730
Annual Passengers (1000's)	2,450	4,070	2,780	2,020	5,240[2]
Daily peak period seats	15,040	15,040	7,140	7,140	12,200
Unit Costs ($/passenger)					
Operating	2.03	1.55	1.19	1.36	1.18
Revenue	0.68	0.71	0.86	0.80	0.74
Deficit	1.35	0.84	0.33	0.56	0.44
Capital	2.48	1.45	1.23	1.42	0.65
Total Subsidy	3.83	2.29	1.56	1.98	1.09

1. Individual figures for Direct and Overhead Operating costs were not available.
2. Lower than actual since these simulated figures reflect competition with Streetsville - Malvern line.

For purposes of comparison, some information on the existing GO Transit service is also shown to provide an indication of the relative efficiency of the various lines. The GO Transit estimates of operating cost and patronage however, are for 1972 since estimates of 1977 patronage exceed capacity and could not be accommodated without additional capital investment in plant and rolling stock. In addition, the patronage forecast includes an allowance for traffic which would be diverted from the GO Transit service if the CP line were in existence in 1972 and is therefore less than volumes actually experienced. The actual patronage on GO Transit in 1972 will probably be closer to six million with a corresponding reduction in the operating deficit of approximately six cents.

Conclusions

As stated in the introduction, one of the major objectives of this study has been to establish a credible information base for negotiations on possible new commuter rail lines servicing Metropolitan Toronto. In keeping with this objective, *no attempt has been made to recommend priorities for development.* There are however, a number of general conclusions which can be drawn based on the information provided in this report as well as specific conclusions which relate to particular services. These are listed below.

1. The analysis of the four lines studied indicate that it is technically feasible to provide a range of commuter rail services on each. For limited peak period services, operating deficits are reasonable in relation to other services presently offered within the metropolitan area. Both operating and capital deficits on a per passenger basis are lower for the limited services (peak period only), than the full services, due to the poor utilization experienced by the latter during off-peak periods.

2. Limited service in peak periods can be accommodated by rescheduling of existing traffic and "fleeting" of commuter trains so as to minimize the need for plant improvements. Extending the duration of the peak period and providing off-peak service results in the need for major plant improvements.

3. For the preferred limited services, operating deficits range from 26 to 41 cents per seat and total deficits from $1.00 to $1.54 per seat. For full services in 1977, operating deficits would range from 33 to 84 cents per passenger and total deficits from $1.56 to $2.29 per passenger. In subsequent years, deficits for full services could of course be expected to decrease. These compare with GO Transit estimates for 1972 of 44 cents and $1.09 for operating and total deficits respectively.

4. Capital investment requirements range from a low of $7.1 million for a limited service on a 21 mile Richmond Hill line to a high of $64 million on the 36 mile line running between Streetsville and Malvern (via Union Station).

5. Time to implement service would range from a minimum of 18 months (as dictated by equipment availability), in the case of the Richmond Hill limited service to a maximum of 3 years for some of the full service alternatives.

6. In terms of capital requirements to inaugurate new services, the preferred limited services can be ranked as follows:

Richmond Hill	- $ 7.1 million (2 trains)
Richmond Hill	- $11.4 million (3 trains)
Georgetown	- $14.5 million (3 trains)
Malvern-Union	- $16.6 million (3 trains)
Malvern-Streetsville	- $37.1 million (3 trains)

For full services, the lines can be ranked as follows:

Richmond Hill	-	\$30.3 million
Georgetown	-	\$36.5 million
Malvern-Streetsville	-	\$63.6 million

7. In terms of estimated daily patronage for full service, the lines can be ranked as follows for 1977:

Georgetown	-	10,200
Malvern-Union	-	8,000
Richmond Hill	-	7,300
Streetsville-Union	-	6,800

For the same year, estimates for the GO Transit Lakeshore East and Lakeshore West services are 12,000 and 10,700 daily trips respectively assuming both Malvern and Streetsville services are in operation. (These Lakeshore East volumes could not be handled without some increase in capacity).

8. The cost effectiveness of continuously expanding the system of commuter rail services is shown in Figure 19 where total capital investment in plant and rolling stock is related to total system A.M. peak period capacity. As the figure illustrates, a quantum jump is experienced by the introduction of off-peak services.

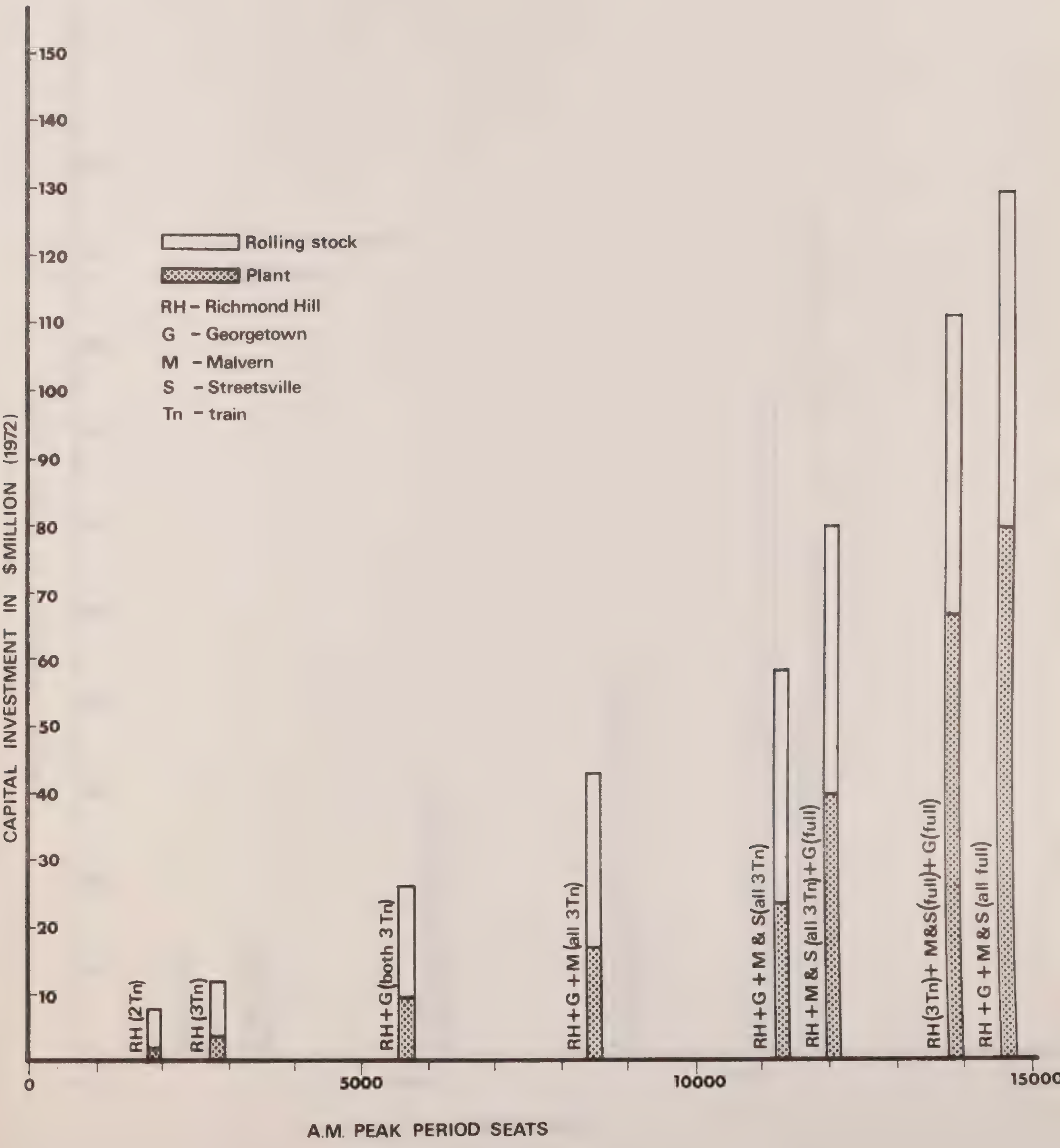
Since the Provincial Government has already announced plans to inaugurate service on the Georgetown line, a similar relationship is shown in Figure 20 for the total system of facilities excluding Georgetown which may be of interest with respect to possible Federal involvement in new services. As shown in this figure, for a minimum capital investment in plant and facilities of $7.1 million, a peak period service providing 1880 seats in each direction could be provided between Richmond Hill and Union Station. Possible combinations of service frequency and number of routes could bring the total capital investment to as much as $94.1 million.

9. In Figures 19 and 20 estimates of the capital requirements for different combinations of services have been obtained by aggregating the plant and equipment requirements for each individual service. The cost estimates also assume separate maintenance operations for each railway. However, in the event of service being provided on several new lines, there would be some possibility of reducing total system rolling stock requirements as a result of improved utilization. For example, rolling stock required for the Georgetown service could probably be cycled to fulfill requirements on the Malvern service for at least one train, with a corresponding reduction in capital cost of approximately $3 million. Possibilities for the joint operation of equipment

TORONTO COMMUTER RAIL STUDY

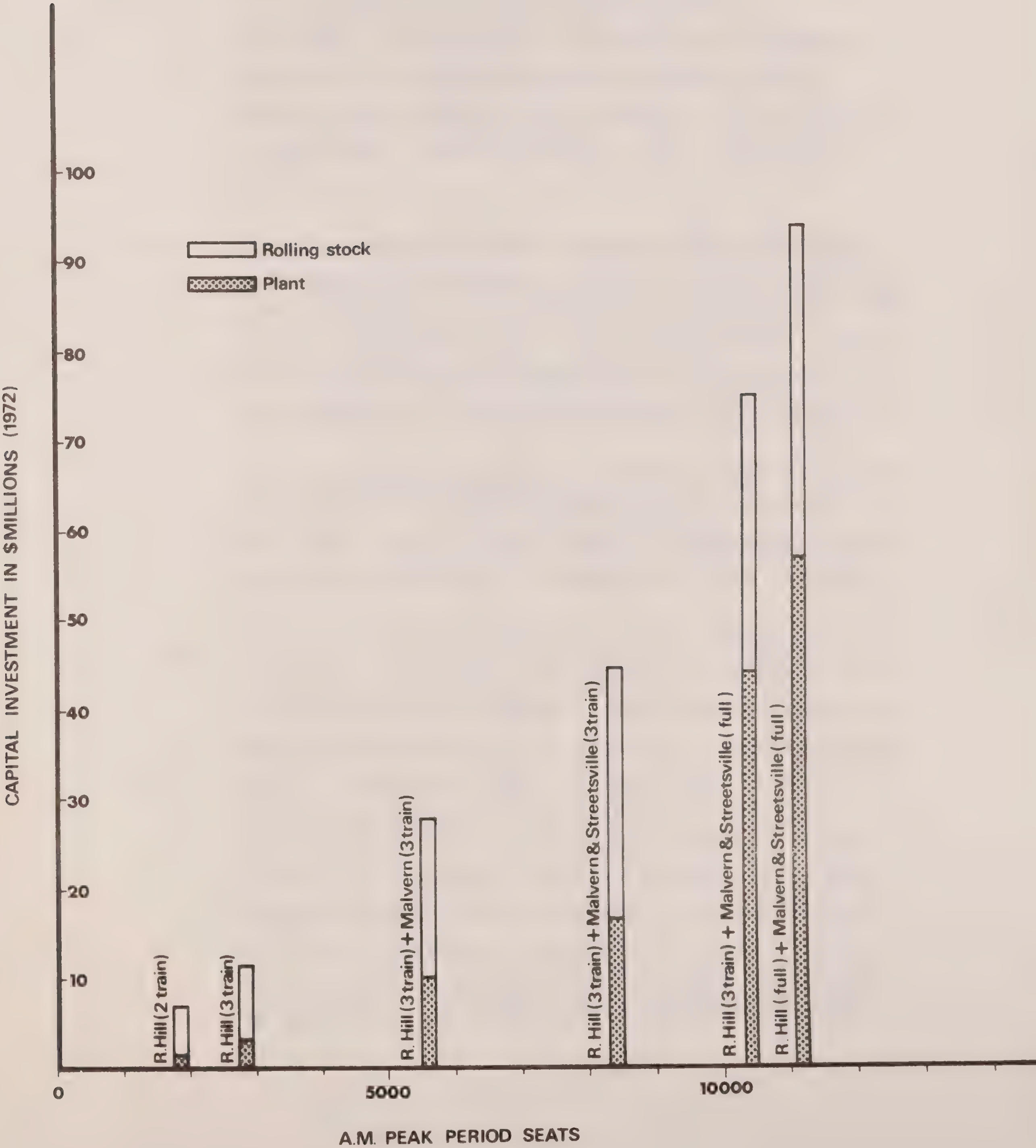
SYSTEM CAPITAL INVESTMENT vs. PEAK CAPACITY

FIG. 19.



TORONTO COMMUTER RAIL STUDY

SYSTEM CAPITAL INVESTMENT vs. PEAK CAPACITY
(EXCLUDING GEORGETOWN) FIG. 20.



would of course have to be discussed with both railways and the railway labour unions. Similarly, introduction of service on a network of facilities involving both CP and CN might present some potential for reducing the cost of rolling stock maintenance and other operating costs.

10. All calculations assume standard fare collection procedures (at stations) as now used by GO Transit. Fare collection costs constitute approximately 20% of total operating costs and some economies could be realized through automation or through the introduction of new fare collection techniques.

11. The various management and overhead fees have been included as they were provided by the railways. Presumably these items would be negotiable between contracting parties in planning for new services.

12. Plans for the development of Metro Centre present particular problems with respect to commuter rail capacity at Union Station. Some reconstruction of these facilities will be required at a considerable cost. According to the railways, the introduction of one additional full service over and above the new Georgetown service will require a major increase in terminal capacity (particularly with respect to the western approach to Union Station). Once this increase in capacity is made, however, it will then be possible to provide a wide range of service without additional plant improvements.

The allocation of the cost associated with these Metro Centre improvements must be made over the entire system of service using these facilities and will have to be the subject of special study involving Metro Centre, the railways and GO Transit. Any of the services shown in the cost estimates which terminate or pass through Union Station therefore do not include any additional allowance for these costs (which could be allocated to the various lines in proportion to their relative peak period frequency).

The construction of Metro Centre also has particular implications for existing car maintenance facilities at CN's Willowbrook yard since CN may now require these facilities for other freight and passenger equipment. The integration of CN and CP commuter rail services would offer possibilities for establishing car maintenance and storage facilities at Leaside on the CP line. This would provide some relief to capacity problems on the western approach to Union Station due to the cycling and deadheading of trains between Union Station and Willowbrook.

13. All of the cost estimates are based on the station locations indicated in Chapter 3. In any detailed planning of new services, however, some consideration should be given to dropping individual stations which are relatively ineffective from a demand point of view. In some cases, other station locations might be preferable. In general, eliminating stations from a line would improve equipment utilization

thereby resulting in significant savings in rolling stock requirements. This is particularly true for the full schedule services. Further savings might be possible for full services if certain trains were short-turned during off-peak periods. As the figures show, any reduction in rolling stock requirements significantly affects total capital costs.

In addition to these general conclusions there are specific comments which can be made on the individual lines treated in this study:

1. Richmond Hill

This line provides the lowest cost limited service in terms of both operating deficit and total subsidy. It also requires the least capital investment namely, $7.1 million for a two train service, $11.4 million for a three train service. At $30.3 million, the capital cost of full service on this line is approximately equal to the capital cost of a limited three train service on the CP route between Streetsville and Malvern.

From a planning point of view, this service fills a void in public transit north of the Don Valley corridor. Once the Don Valley Parkway extension is constructed, congestion on this facility should lead to even more demand for public transportation during peak periods. To some extent, the Richmond Hill service will compete with the Yonge Street subway extension when it is opened to Finch in 1974.

However, with the overloading expected on the Yonge Street subway, rail service with relatively few stops to Union Station would be an extremely attractive alternative and would provide welcome relief to the subway. With the introduction of the subway, traffic forecasts suggest that the York Mills station becomes very ineffective. In any final analysis of this line, consideration should be given to dropping that station or relocating it to Sheppard Avenue in order to obtain a better interface with Highway 401.

The peak period service also provides the opportunity for a good surface connection to Aurora and Newmarket via GO Transit buses. During off-peak periods, these buses could provide direct downtown service by connections to the Finch subway station. The area served by the Richmond Hill line is highly automobile oriented and it is therefore questionable whether a full service would attract much off-peak patronage particularly when the Don Valley Parkway is extended. Full schedule service would also be questionable in the light of the Toronto Centred Region concept objectives for limited growth in this area.

With respect to the limited services, the additional cost of expanding a two train service to a three train service seems high, even excluding the additional capital requirements, and must be attributed to an increase in overhead fees. This

results largely because of the need to expand car maintenance facilities at a time when the new Georgetown service will be placing demands on the same facility. Presumably, this additional overhead cost should be spread over the different services using these maintenance facilities and not charged entirely to the Richmond Hill service.

In the short term, the best potential for this line appears to be a limited two or three train service although to make any substantial impression on travel demand in this corridor, the three train service would be preferable. *In this respect, some of the costs associated with the three train service should be reassessed.* Track improvements for limited service are minimal and operation could probably be inaugurated earlier than on any other line under consideration.

2. Georgetown

As indicated previously, the Provincial Government has already announced plans to initiate limited peak period service on this line in late 1973. This line has a natural advantage in that it is diagonal to the grid of roads and transit services and therefore shortens trips to the downtown area. It also provides for a good connection with the Bloor Street subway thereby increasing the opportunities for distribution in the central area of the city. For trips originating in the corridor served by this line there are no reasonable high speed

alternatives by public transit for the great majority of potential users. As indicated in the demand analysis, the volumes on this service compare favourably with the existing Lakeshore service.

To some extent, the provision of commuter rail service as far as Georgetown conflicts with the objectives of the Toronto Centred Region concept and presumably any increases in service frequency in the future would be limited to points east of Brampton. The line also provides for limited reverse flows to the Woodbine race track and Toronto International Airport at Malton.

3. Streetsville

The major advantage of the Streetsville line is that it taps some of the same market now served by the GO Transit Lakeshore West line, thereby providing relief to the capacity problems being experienced on the latter. In the short term it has the lowest volume potential of the lines studied.

Although the effect of running this service through the North Toronto station has not been simulated, it is generally agreed that patronage would be substantially reduced and the potential relief for the Lakeshore West service would not be provided. On the other hand, there are serious local planning criteria which could favour an alternative downtown

terminal to Union Station. The possible impact of running the service through North Toronto would therefore have to be examined more closely if a decision were reached to offer commuter rail service to Streetsville (and Malvern as well). In general, the demand analysis suggests that provision of commuter rail service to the North Toronto station may only be a very long term alternative. Plans to develop new technologies to service demand in this corridor might preclude conventional commuter rail services at that time.

4. Malvern

The Malvern line runs diagonally from downtown and has some of the natural advantages of the Georgetown route with respect to shortening trip lengths. At present, no reasonable high speed transit is available in the corridor served by the line. Limited service on this route offers possibilities for integration with CN limited service on the Georgetown route, with corresponding improvements in utilization of rolling stock and reductions in capital investment.

From a planning point of view, the Malvern line could be used to support the planned growth in the east. This is particularly true in the case of the new development at Malvern and in connection with the airport related developments at Cedarwood (which would require extending the route beyond Malvern).

The short term potential of this route is fairly low in relation to Georgetown, but with the planned

growth of population in the east it has a relatively high potential for the medium and long term future. As studies of ground access for the Pickering Airport proceed, possibilities for integrated airport access services with commuter rail services on this line may be developed. A sharing of the cost of capital improvements between airport users and commuter traffic would result in a reduction in the unit capital costs on this service thereby improving its cost effectiveness considerably.

As in the case of the Streetsville service, there are two options for downtown terminals on this line. Here however, the choice of a Union Station or North Toronto terminal is expected to have little effect on patronage estimates since there is little competition between the Malvern and Lakeshore East routes.

In summary therefore, investment in limited peak period services on the Richmond Hill, Malvern, and Georgetown routes appear to be reasonably effective in terms of potential demand, unit costs and subsidy requirements. The western half of the CP route to Streetsville appears to have less potential in the short term (except as an option to increasing Lakeshore West capacity), and is particularly sensitive to the choice of a downtown terminal location. For full services, the Georgetown and Malvern lines both appear attractive. Experience gained in operating the limited services on the Georgetown route will provide a reasonable basis for considering expansions in service frequency.

Ultimately, expanding the service on the CP route to Malvern would appear reasonable, given the growth objectives for both airport and non-airport related activities. The Richmond Hill route would appear to have little requirement for off-peak service, given the competition afforded by the subway system.

It must be emphasized that decisions relating to the provision of new commuter rail services should not be made in isolation of other elements of the total transportation system. *Unilateral decisions by independent agencies with respect to any one mode of public transportation can be inconsistent with comprehensive plans for transportation and plans for the integration and co-ordination of all modes.* Commuter rail services should not compete with other transit services, except where it is intended to provide additional capacity or relief; nor should they be planned without consideration of their interface with other modes and the need to adequately integrate with feeder and distribution systems.

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